5-6675-232-15

TM 5-6675-232-15

DEPARTMENT OF THE ARMY TECHNICAL MANUAL

OPERATOR, ORGANIZATIONAL, FIELD, AND DEPOT MAINTENANCE MANUAL

THEODOLITE: DIRECTIONAL; 1 MIN. GRADUATION; 5.9 IN. LONG TELESCOPE W/ACCESSORIES (WILD HEERBRUGG MODEL T-16 TYPE I)

FSN 6675-828-6397

This reprint includes all changes in effect at the time of publication; change 4.

HEADQUARTERS, DEPARTMENT OF THE ARMY
JULY 1963

AGO 5456A

READEX FICHE best copy available

Changes in force: C4

*TM 5-6675-232-15
C4

CHANGE
NO. 4

HEADQUARTERS
DEPARTMENT OF THE ARMY
Washington, DC, *9 November 1978*

Operator, Organizational, Direct Support, General Support, and Depot Maintenance Manual

THEODOLITE: DIRECTIONAL; 1 MIN. GRADUATION 5.9 IN. LONG TELESCOPE, W/ACCESSORIES (WILD HEERBRUGG MODEL T-16 TYPE 1)

NSN 6675-00-828-6397

TM 5-6675-232-15, 26 July 1963, is changed as follows:

Page 1. Preceding the Table of Contents, add the following:

"Reporting Errors and Recommending Improvements. You can help improve this manual. If you find any mistakes, or if you know of a way to improve the procedures, please let us know. Mail your letter, or DA Form 2028 (Recommended Changes to Publications and Blank Forms), direct to: Commander, U.S. Army Troop Support & Aviation Materiel Readiness Command, ATTN: DRSTS-MTPS, 4300 Goodfellow Blvd., St. Louis, MO 63120. A reply will be furnished to you."

Page 3. Para. 1 *d* is deleted in its entirety

Page 2. Table of Contents Page. Immediately after Step XVII, Change the appendixes to read as follows:

Appendix I. References
II. Components of End Item List
III. Additional Authorization List
Appendix IV. Maintenance Allocation Chart
V. Expendable Supplies and Materials List
Index

Page 3. Para 1 *d* is deleted in its entirety.

Page 98. Appendix I References. After Appendix I, add Appendix II as follows:

---

*This change supersedes C3, 7 July 1972.

APPENDIX II
COMPONENTS OF END ITEMS LIST
Section I. INTRODUCTION

1. Scope

This appendix lists Integral Components of and Basic Issue Items (BII) for the theodolite to help you inventory items required for safe and efficient operation.

2 General

The components of end item list are divided into the following sections:

a. Section II. Integral Components of the End Item. These items, when assembled, comprise the theodolite and must accompany it whenever it is transferred or turned in. These illustrations will help you identify these items.

b. Section III. Basic Issue Items. These are minimum essential items required to place the theodolite in operation, to operate it and to perform emergency repairs. Although shipped separately packed, they must accompany the theodolite during operation and whenever it is transferred between accountable officers. The illustrations will assist you with hard-to-identify items. This manual is your authority to requisition replacement BII based on Table(s) of Organization and Equipment (TOE)/ Modification Table of Organization and Equipment (MTOE) authorization of the end item.

3. Explanation of Columns

a. Illustration. This column is divided as follows:

(1) **Figure Number.** Indicates the figure number of the illustration on which the item is shown (if applicable).

(2) **Item Number.** The number used to identify item called out in the illustration.

b. National stock Number (NSN). Indicates the national stock number assigned to the end item which will be used for requisitioning.

c. Part Number (P/N). Indicates the primary number used by the manufacturer which controls the design and characteristics of the item by means of its engineering drawings, specifications, standards and inspection requirements to identify an item or range of items.

d. Description. Indicates the federal item name and, if required, a minimum description to identify the item.

e. Location. The physical location of each item listed is given in this column. The lists are designed to inventory all items in one area of the major item before moving on the an adjacent area.

f. Usable on Code: "USABLE ON" codes are included to help you identify which component items are used on the different models. Identification of the codes used in this list area: N/A.

g. Quantity Required (Qty Read). This column lists the quantity of each item required for a complete major item.

h. Quantity. This column is left blank for use during inventory. Under the received column, list the quantity you actually receive on your major item. The date columns are for use when you inventory the major item at a later date, such as for shipment to another site.

Section II. INTEGRAL COMPONENTS OF END ITEM

(1) ILLUSTRATION (a) FIGURE NO.	(1) ILLUSTRATION (b) ITEM NO.	(2) NATIONAL STOCK NO.	(3) PART NO. & FSCM	(4) DESCRIPTION	(5) LOCATION	(6) USABLE ON CODE	(7) QTY REQD	(8) QUANTITY RCVD	DATE	DATE	DATE
3		SMR=X2	ST16-121A (89905)	Tribrach Assembly		ALU	1				
19		6675-00-404-4400	T16-720 (89905)	Sunshade		ALU	1				
7			XT16-112 (89905)	Mirror Assembly		ALU	1				
7		6675-00-036-2225	XT16-108 (89905)	Case, Assembly		ALU	1				
7		SMR=X2	XT16-107 (89905)	Hood Assembly		ALU	1				
9		6675-00-830-8689	NT1-893 (89905)	Base Assembly		ALU	1				
6		6675-00-069-6059	NT1-517 (89905)	Container, Desiccant		ALU	1				
12		6675-00-023-5052	MDS1-2A (89905)	Case Shipping		ALU	1				
13				Field Pack, Canvas		ALU	1				
				Case, Accessory containing the following:		ALU	1				
13		6675-00-560-5472	T16-761 (89905)	Case, Assembly		ALU	1				
13		6675-00-378-9401	NT2-549 (89905)	Cover, Instrument		ALU	1				
13		6675-00-867-5561	XT16-118ADEG (89905)	Compass Assembly		ALU	1				
13		6675-00-560-5586	XT16-115A (89905)	Prism Assembly, Telescope eyepiece		ALU	1				
13		6675-00-560-5587	XT16-117 (89905)	Prism Assembly, Microscope eyepiece		ALU	1				
13		6675-00-446-1768	XT16-116A (89905)	Sunglass I		ALU	1				
13		6675-00-624-3686	XT2-92 (89905)	Sunglass II Black		ALU	1				
14				Battery Box Assembly, containing the following:		ALU	1				
14		6675-00-997-4340	XT2-74 (89905)	Box Assembly							
14		6135-00-937-4118	GEB10-000-000 (89905)	Battery		ALU	1				
14		6675-00-997-4335	GEB1-00-000-66 (89905)	Battery, Dummy		ALU	1				
14		6150-00-378-9500	XT2-72 (89905)	Handlamp Assembly w/ lamp		ALU	1				
14		6675-00-560-5649	XT16-113(89905)	Lead, Electrical (Battery Cable)		ALU	1				
10		6675-00-641-3572	21B (89905)	Illumination Assembly, w/ holder		ALU	1				
10		6675-00-378-9525	3A63 (89905)	Tripod Assembly, extension leg consisting of:		ALU	1				
11		6675-00-937-3838	2A20A23A (89905)	Cover, Head		ALU	1				
11		5120-00-429-2949	3A29 (89905)	Kit Assembly, Tool		ALU	1				
11		5120-00-238-3299	XT2-35A (89905)	Wrench, Tripod		ALU	1				
				Plumb Bob assembly w/ adjustor		ALU	1				

Section III. BASIC ISSUE ITEMS

(1) ILLUSTRATION		(2) NATIONAL STOCK NO.	(3) PART NO. & FSCM	(4) DESCRIPTION	(5) LOCATION	(6) USABLE ON CODE	(7) QTY REQD	(8) QUANTITY			
(a) FIGURE NO.	(b) ITEM NO.							RCVD	DATE	DATE	DATE
				TM 5-6675-232-15 Operator, Organizational Direct Support, General Support and Depot Maintenance Manual		ALU	1				
13		6675-00-353-4103	3A55 (89905)	Pin Adjusting		ALU	2				
13		5120-00-429-2948	HDW1-5 (89905)	Screw driver, jewelers		ALU	1				
13		5120-00-446-2860	HDW1-10 (89905)	Screw-driver, large		ALU	1				
13		8330-00-965-1722	KKC300 (89005)	Chamois		ALU	1				
13		7920-00-011-8517	3A59 (89905)	Brush, Dust		ALU	1				
13		6675-00-859-5936	HEG-64 (89905)	Lamp		ALU	4				
13		6675-00-446-1762	HDF3-4 (89905)	Container, Lubricant		ALU	1				

After Appendix II, add Appendix III as follows:

APPENDIX III
ADDITIONAL AUTHORIZATION LIST
Section I. INTRODUCTION

1. Scope

This appendix lists additional items you are authorized for the support of the theodolite.

2. General

This list identifies items that do not have to accompany the theodolite and that do not have to be turned in with it. These items are authorized to you by CTA, MTOE, TDA or JTA.

3. Explanation of Listing

National stock number, descriptions and quantities are provided to help you identify and request the additional items you require to support this equipment. "USABLE ON" codes are identified as follows: N/A.

Section II. ADDITIONAL AUTHORIZATION LIST

(1) NATIONAL STOCK NUMBER	(2) PART NUMBER & FSCM	(3) DESCRIPTION	(4) USABLE ON CODE	U/M	QTY AUTH
	BA30 (81349)	Battery, Dry 1.5 Volts	ALU	EA	8

Page 99. Change Appendix II, Maintenance Allocation Chart to read Appendix IV, Maintenance Allocation Chart and add after Appendix III.

After Appendix IV, add Appendix V as follows:

APPENDIX V

EXPENDABLE SUPPLIES AND MATERIALS LIST

Section I. INTRODUCTION

1. SCOPE.

This appendix lists expendable supplies and materials you will need to operate and maintain the Theodolite. These items are authorized to you by CTA50-970, Expendable Items (except Medical, Class V, Repair Parts, and Heraldic Items).

2. EXPLANATION OF COLUMNS.

a. Column 1 - Item Number. This number is assigned to the entry in the listing and is referenced in the narrative instructions to identify the material (e.g., " Use cleaning compound, Item 5, App. D").

b. Column 2 - Level. This column identifies the lowest level of maintenance that requires the listed item.

C - Operator/Crew
O - Organizational Maintenance
F - Direct Support Maintenance
H - General Support Maintenance

c. Column 3 - National Stock Number. This is the National stock number assigned to the item; use it to request or requisition the item.

d. Column 4 - Description. Indicates the Federal item name and, if required, a description to identify the item. The last line for each item indicates the part number followed by the Federal Supply Code for Manufacturer (FSCM) in parenthesis, if applicable.

e. Column 5 - Unit of Measure (U/M). Indicates the measure used in performing the actual maintenance function. This measure is expressed by a two-character alphabetical abbreviation (e.g., ea, in, pr). If the unit of measure differs from the unit of issue, requisition the lowest unit of issue that will satisfy your requirements.

Section II. EXPENDABLE SUPPLIES AND MATERIALS LIST

(1) ITEM NUMBER	(2) LEVEL	(3) NATIONAL STOCK NUMBER	(4) DESCRIPTION	(5) U/M
1	C	7920-00-401-8035	Cloth, Lint-free, non-abrasive, General Purpose, Part No. 1001	BX
2	C		Grease, Instrument and Aircraft (GIA) MIL-G-23827	TU
3	C	9150-00-252-6382	Oil, Clock and Watch (OCW) 5cc	BT
4	C	6810-00-223-2739	Acetone Technical 1 pt can; Fed. Spec. MMM-A-185	PT
5	C	6850-00-664-5683	Cleaning Solvent Fed. Spec. FD-680	QT
6	C	6850-00-680-2233	Desiccant Activatedty 1.5lb	LB
7	C		Lens Tissue NNNP40TYPEICLASSI (81348)	PKG
8	C		Orange Sticks 13218E3063 (97403)	PKG

By Order of the Secretary of the Army:

BERNARD W. ROGERS
General, United States Army
Chief of Staff

Official:

J. C. PENNINGTON
Brigadier General, United States Army
The Adjutant General

Distribution:
To be distributed in accordance with DA Form 12-25A, Operator maintenance requirements for Surveying Equipment.

TECHNICAL MANUAL
No. 5-6675-232-15

HEADQUARTERS,
DEPARTMENT OF THE ARMY
WASHINGTON 25, D.C., *26 July 1963*

Operator, Organizational, Field, and Depot Maintenance Manual

THEODOLITE: DIRECTIONAL; 1 MIN. GRADUATION; 5.9 IN. LONG TELESCOPE W/ACCESSORIES (WILD HEERBRUGG MODEL T-16 TYPE I) FSN 6675-828-6397

		Paragraph	Page
CHAPTER 1.	INTRODUCTION		
Section I.	General	1, 2	3
II.	Description and data	3-5	3
CHAPTER 2.	INSTALLATION AND OPERATION INSTRUCTIONS		
Section I.	Service upon receipt of equipment	6-11	9
II.	Movement to a new worksite	12, 13	22
III.	Controls and instruments	14, 15	23
IV.	Operation of equipment	16-23	26
CHAPTER 3.	OPERATOR AND ORGANIZATIONAL MAINTENANCE INSTRUCTIONS		
Section I.	Operator and organizational maintenance tools and equipment	24-27	33
II.	Lubrication	28, 29	33
III.	Preventive maintenance services	30-32	35
IV.	Operator's maintenance	33, 34	40
V.	Troubleshooting	35-53	40
VI.	Carrying case and canvas field pack	54-56	42
VII.	Telescope and microscope eyepieces	57-59	44
VIII.	Tribrach assembly	60, 61	45
IX.	Illumination mirror assembly	62, 63	46
X.	Telescope level assembly	64, 65	47
XI.	Tripod assembly, plumb bob assembly, and tripod wrench	66-68	47
CHAPTER 4.	DEMOLITION OF THEODOLITE TO PREVENT ENEMY USE	69-71	50
5.	SHIPMENT AND LIMITED STORAGE		
Section I.	Shipment within zone of interior	72, 73	51
II.	Limited storage	74, 75	51
CHAPTER 6.	FIELD AND DEPOT MAINTENANCE INSTRUCTIONS		
Section I.	General	76, 77	53
II.	Description and data	78, 79	53
III.	Special tools and equipment	80-82	56
IV.	Troubleshooting	83-101	58
V.	Tribrach assembly	102, 103	60
VI.	Collimation level cover, collimation level mirror, and illumination mirror, and reticle mirror assemblies.	104-107	61
VII.	Horizontal circle clamp and horizontal circle prism assemblies	*108, 109*	63
VIII.	Horizontal slow-motion screw, horizontal circle housing and inner base, horizontal clamp and horizontal circle assembly and outer vertical axis.	110-113	66
IX.	Optical plumb device and eyepiece assembly and inner vertical axis	114-116	71
X.	Plate level assembly and clamp pins	117, 118	73
XI.	Right-side support cover, vertical clamp, and vertical slow-motion screw	119-121	75
XII.	Vertical collimation level assembly, left-side support cover, vertical collimation housing, vertical collimation lever, vertical circle, and collimation slow-motion screw assemblies.	122-126	77

Paragraph Page

Section XIII. Reading lens, illumination lens, and combination prism and lens assemblies 127–129 83
XIV. Microscope, telescope eyepiece and reticle, telescope focus and objective, and telescope level assemblies. 130–133 85
XV. Telescope axis, 90° prism, and U-standard assemblies 134, 135 90
XVI. Illumination system 136, 139 92
XVII. Compass and compass bridge assembly 140, 141 95

APPENDIX I. REFERENCES 98
II. MAINTENANCE ALLOCATION CHART 99
III. BASIC ISSUE ITEMS 104

INDEX 109

CHAPTER 1

INTRODUCTION

Section I. GENERAL

1. Scope

a. These instructions are published for the use of the personnel to whom the Wild Heerbrugg Model T-16 Theodolite is issued. Chapters 1 through 5 provide information on the operation, daily preventive maintenance services, and organizational maintenance of the equipment, accessories, components, and attachments. Chapter 6 provides information for field and depot maintenance (3d, 4th, and 5th echelons). This manual also provides descriptions of the main units and their functions in relationship to other components.

b. Appendix I contains a list of publications applicable to this manual. Appendix II contains the maintenance allocation chart. Appendix III contains the list of basic issue items authorized the operator of this equipment. The organizational, field, and depot maintenance repair parts and special tool lists are listed in TM 5-6675-232-25P.

c. Numbers in parentheses on illustrations indicate quantity. Numbers preceding nomenclature callouts on illustrations indicate the preferred maintenance sequence.

d. Report all deficiencies in this manual on DA Form 2028 (Recommended Changes to DA Technical Manual Parts Lists or Supply Manual 7, 8 or 9). Submit recommendations for changes, additions, or deletions to the Commanding Officer, U. S. Army Mobility Support Center, ATTN: SMOMS-MS, P. O. Box 119, Columbus 16, Ohio. Direct communication is authorized.

e. Report unsatisfactory performance and suggestions for equipment improvement as specified in AR 750-5.

2. Record and Report Forms

For record and report forms applicable to the operator, crew, and organizational maintenance, refer to TM 38-750.

Note. Applicable forms, excluding Standard Form 46 (United States Government Motor Vehicle Operator's Identification Card), which is carried by the operator, will be kept in a canvas bag mounted on the equipment.

Section II. DESCRIPTION AND DATA

3. Description

The Wild Heerbrugg Model T-16, Type I Theodolite (figs. 1-4) is a precision, directional-type surveying and tracking instrument. It has both vertical and horizontal scales, calibrated in degrees and minutes for reading the values of angles. Such readings are made through the mircroscope eyepiece (fig. 1), located to the right of the telescope eyepiece. The tribrach and star plate (fig. 3) support the main body of the instrument, which is readily detachable from the tribrach. The latter contains the leveling screws, circular level, and tribrach clamp lever.

4. Identification and Tabulated Data

a. Identification. The theodolite has two identification markings. One appears on the theodolite hood and one on the right side cover of the instrument. The data stenciled on the hood and engraved on the right-side cover can be found in the tabulated data.

b. Tabulated Data.

(1) *General.*

Manufacturer	Wild Heerbrugg Ltd., Heerbrugg, Switzerland
Model	T-16, Type I
Telescope	28x (power)

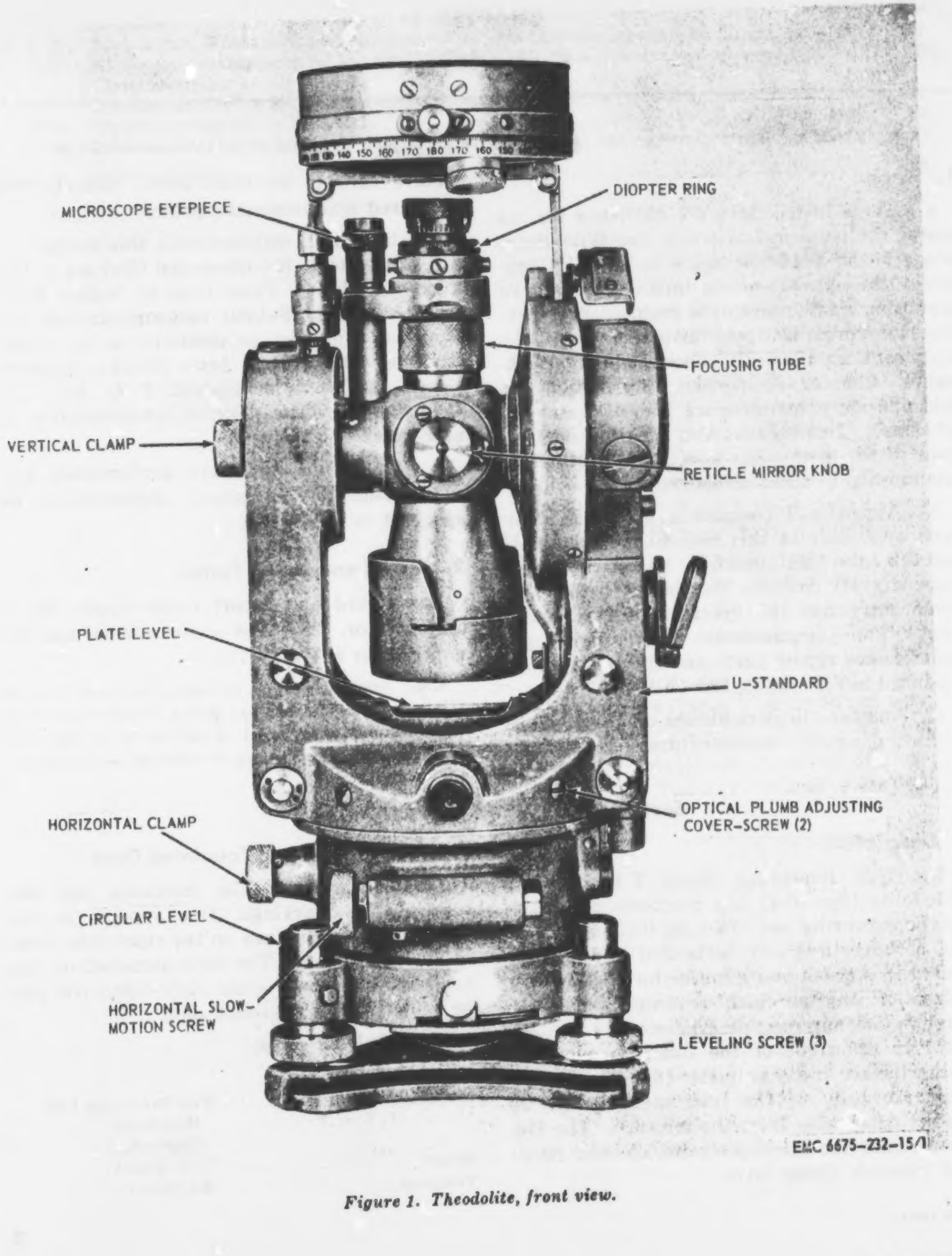
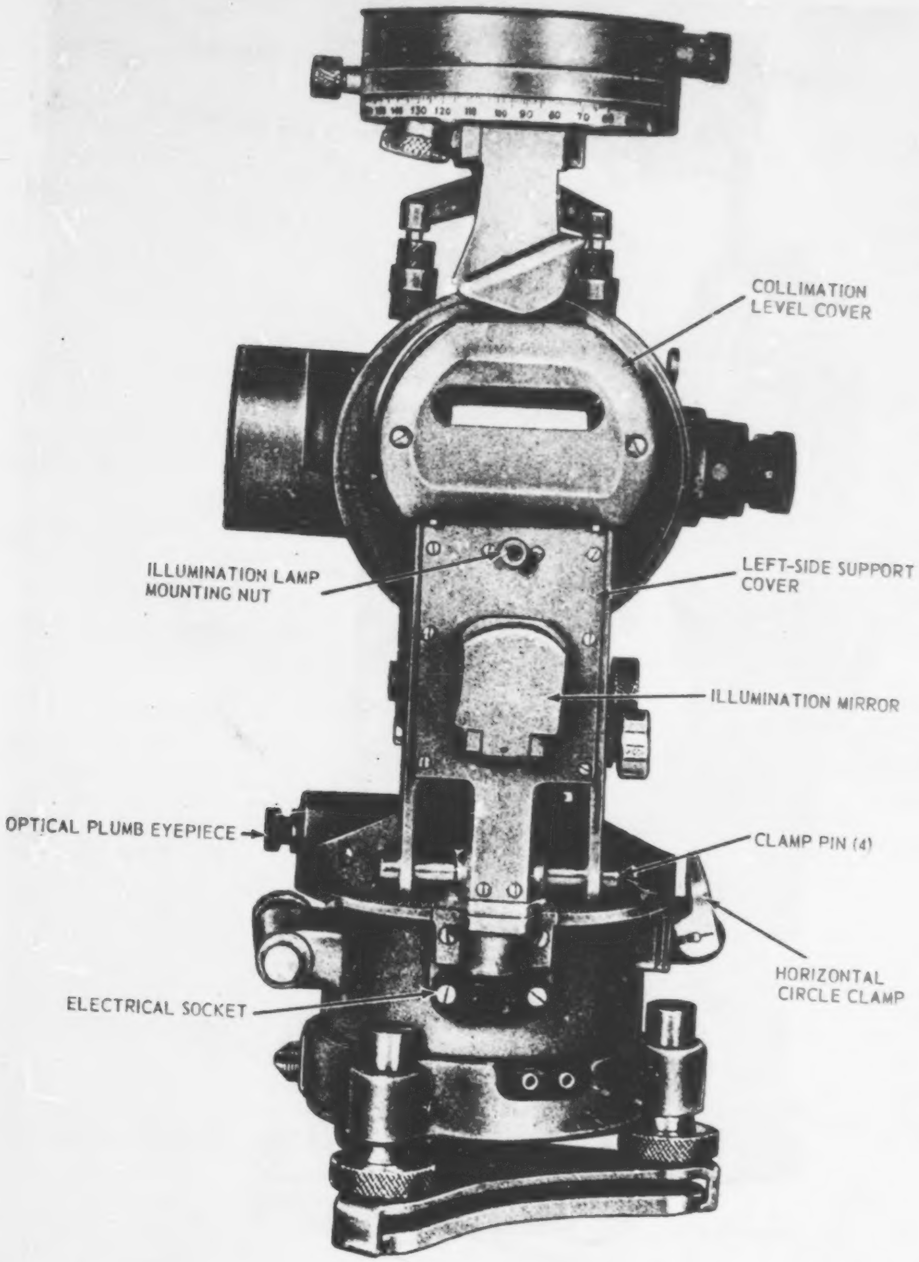

MICROSCOPE EYEPIECE
DIOPTER RING
FOCUSING TUBE
VERTICAL CLAMP
RETICLE MIRROR KNOB
PLATE LEVEL
U-STANDARD
OPTICAL PLUMB ADJUSTING COVER-SCREW (2)
HORIZONTAL CLAMP
CIRCULAR LEVEL
HORIZONTAL SLOW-MOTION SCREW
LEVELING SCREW (3)
EMC 6675-232-15/1

Figure 1. Theodolite, front view.


COLLIMATION LEVEL COVER
ILLUMINATION LAMP MOUNTING NUT
LEFT-SIDE SUPPORT COVER
ILLUMINATION MIRROR
OPTICAL PLUMB EYEPIECE
CLAMP PIN (4)
HORIZONTAL CIRCLE CLAMP
ELECTRICAL SOCKET

EMC 6675-232-15/2

Figure 2. Theodolite, left-side view.

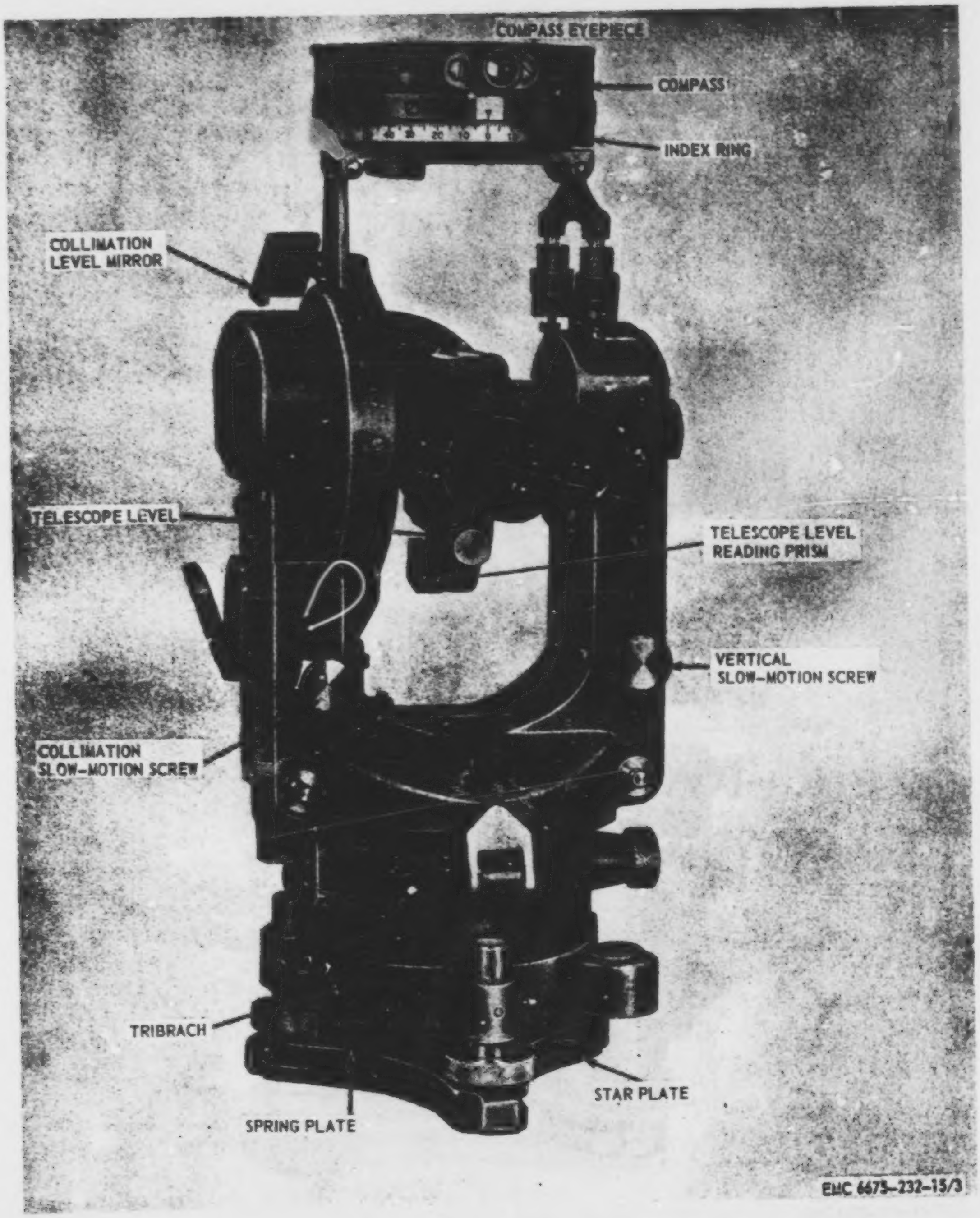
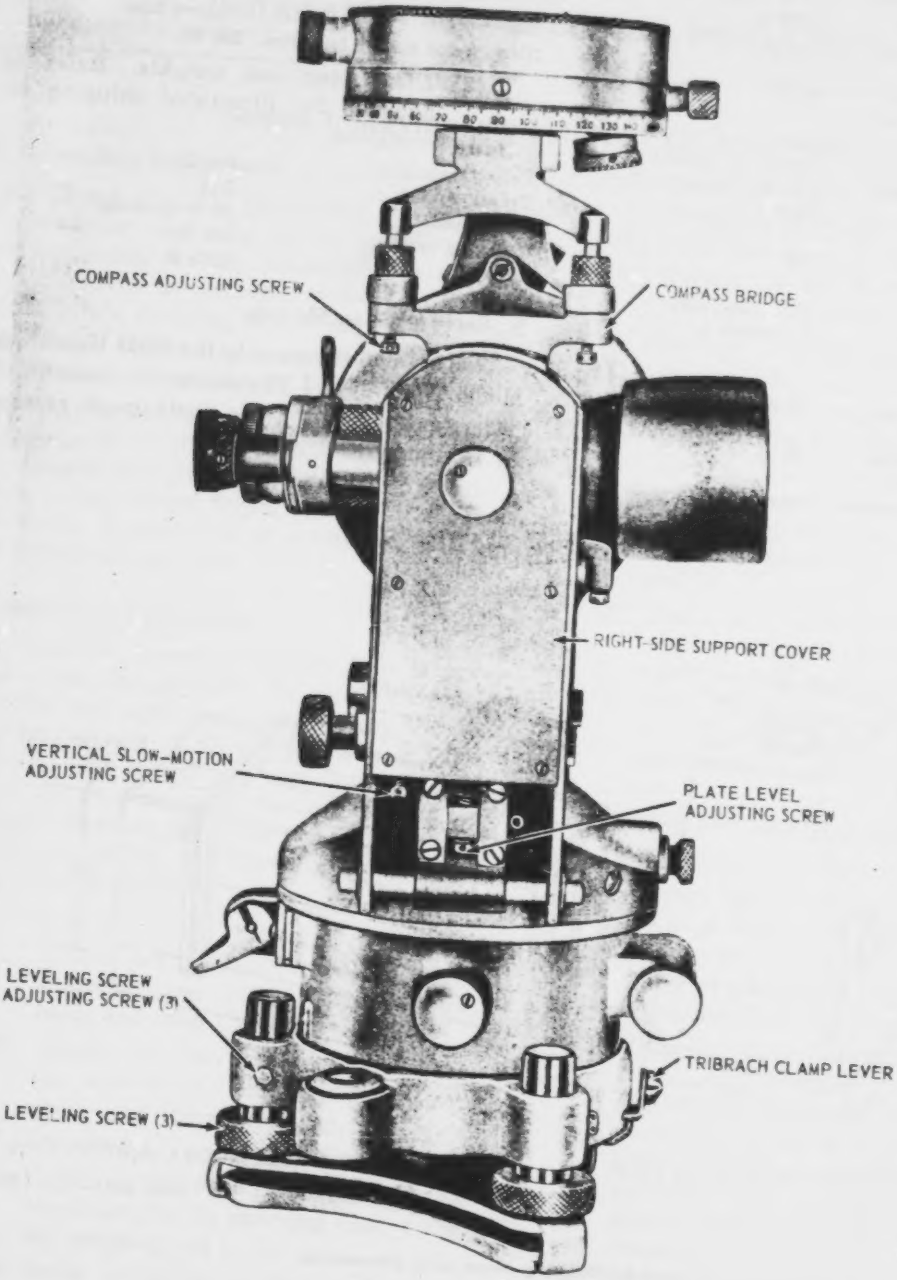

COMPASS EYEPIECE
COMPASS
INDEX RING
COLLIMATION LEVEL MIRROR
TELESCOPE LEVEL
TELESCOPE LEVEL READING PRISM
VERTICAL SLOW-MOTION SCREW
COLLIMATION SLOW-MOTION SCREW
TRIBRACH
STAR PLATE
SPRING PLATE
EMC 6675-232-15/3

Figure 3. Theodolite, rear view.


COMPASS ADJUSTING SCREW
COMPASS BRIDGE
RIGHT-SIDE SUPPORT COVER
VERTICAL SLOW-MOTION ADJUSTING SCREW
PLATE LEVEL ADJUSTING SCREW
LEVELING SCREW ADJUSTING SCREW (3)
TRIBRACH CLAMP LEVER
LEVELING SCREW (3)

EMC 6675-232-15/4

Figure 4. Theodolite, right-side view.

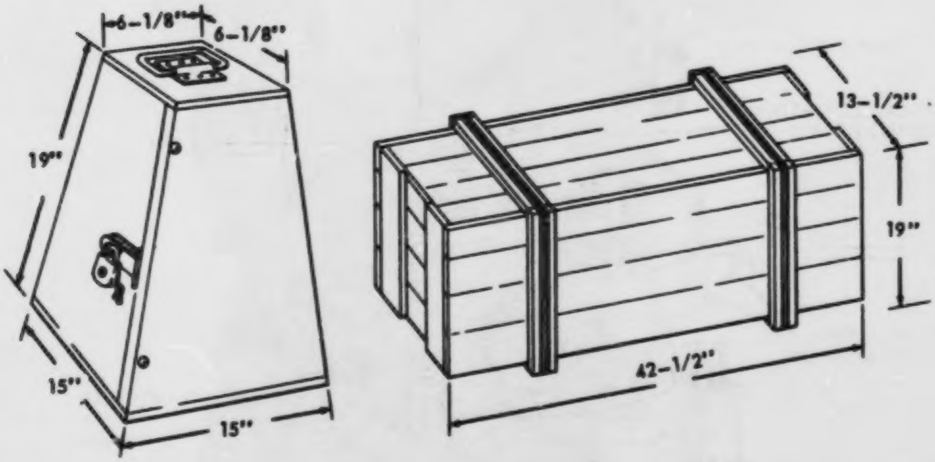
Shortest focusing distance	4.5 ft (feet)
Longest aiming distance at which centimeter can be read.	1,000 ft
Longest aiming distance at which millimeter can be evaluated.	450 ft
Normal range	6 to 12 mi (miles)
Clear objective aperture	1.57 in. (inches)
Diameter of field at 1,000 ft.	29 ft
Multiplication constant	100
Addition constant	0
Glass circles	360° (degrees)
Graduation interval of horizontal and vertical circles.	1' (minute)
Sensitivity of plate level	30 in. per 2 mm (millimeter)
Sensitivity of collimation level.	30 in. per 2 mm
Magnification of microscope	40x
Illumination system lamps	4 v (volts), 3 amp (amperes), miniature screw base
Illumination system batteries	BA 30

(2) *Dimensions and weights.* Refer to figure 5 for illustrated shipping dimensions.

Tripod, extended	5⅛ ft
Tripod, folded	3 ft
Instrument	10 lb (pounds)
Carrying case	3⅝ lb
Tripod	12⅛ lb

5. Difference in Models

This manual covers only the Wild Heerbrugg Model T-16, Type I Theodolite. No known unit differences exist for the instrument covered by this manual.



A. THEODOLITE SHIPPING CASE.

B. TRIPOD AND ACCESSORIES SHIPPING CASE.

EMC 6675-232-15/5

Figure 5. Shipping cases, with dimensions.

CHAPTER 2

INSTALLATION AND OPERATION INSTRUCTIONS

Section I. SERVICE UPON RECEIPT OF EQUIPMENT

6. Unloading Equipment

a. Theodolite. All theodolites are shipped in a shipping case (fig. 5), equipped with a carrying handle on top. Unloading the instrument presents no problem, since the loaded weight of the shipping case is only 30 pounds.

Caution: **Handle the cased theodolite carefully to avoid damaging the instrument.**

b. Tripod and Accessories. The tripod and accessories used with the theodolite are shipped in a separate shipping crate (fig. 5). The total weight of the crated tripod and accessories is 62 pounds. A handtruck or manpower may be used to unload the crate.

7. Unpacking Equipment

a. General. Select a location that is protected from the weather for unpacking the theodolite and its accessories. Set the theodolite shipping case up off the ground, on a box or table. The tripod shipping crate may be utilized for this purpose. Do not discard the theodolite shipping case after unpacking. Also, save the tripod and accessories shipping crate and packing materials.

b. Theodolite.

(1) Unlock the padlock on the theodolite shipping case, remove it from the hasp, and open the hasp.

(2) Loosen the two captive screws near the edge of the shipping case door, above and below the hasp, and open the door.

(3) Refer to figure 6 and remove the theodolite, in its carrying case, from the shipping case.

(4) Refer to figure 7 and remove the carrying case hood.

(5) Refer to figure 8 and remove the theodolite from the base.

(6) Close the door of the shipping case, tighten the two captive screws, close the hasp, and attach the padlock to it.

c. Tripod and Accessories.

(1) Remove the nails fastening the top of the tripod shipping crate and remove the top in one piece.

(2) Remove the wrapped tripod, field pack, accessory case, battery case, and the packing material from the crate. Carefully remove all wrapping material.

(3) Check the accessories against the packing list and report all discrepancies to field maintenance.

(4) Put wrapping and packing back in the crate and replace the top. Store the crate in a safe place.

8. Inspecting and Servicing Equipment

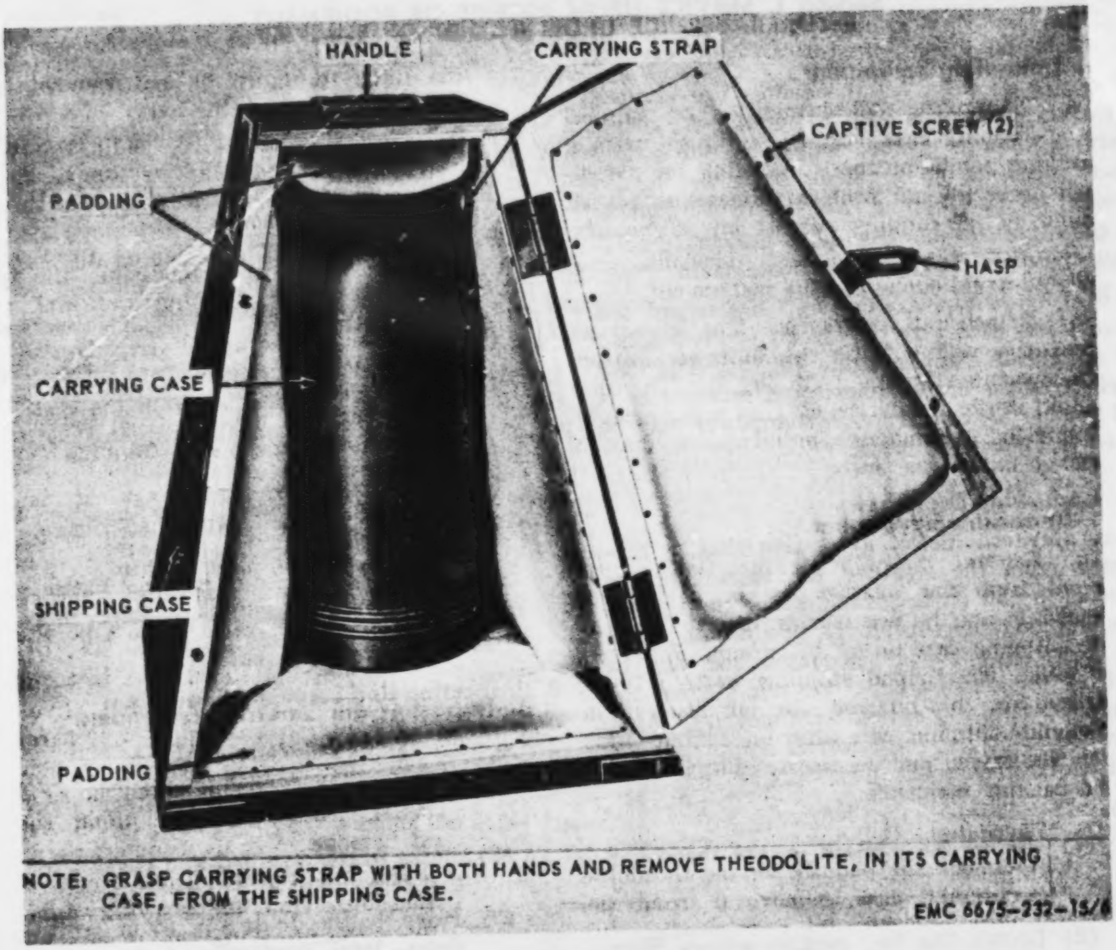
a. Theodolite and Carrying Case.

(1) Inspect the carrying case (fig. 7) for dents, cracks, rust, and other signs of damage.

(2) Refer to paragraph 7 and remove the theodolite from the carrying case.

(3) Place the theodolite (fig. 9) on a firm, clean, level surface and inspect it visually for broken or missing parts, cracked or scratched lenses or mirrors, loose or missing mounting hardware, and other signs of damage. Report all damage and deficiencies to field maintenance.

(4) Remove the desiccant container (fig. 9) from the base and observe its color. It should be blue. Desiccant


HANDLE
CARRYING STRAP
CAPTIVE SCREW (2)
PADDING
HASP
CARRYING CASE
SHIPPING CASE
PADDING

NOTE: GRASP CARRYING STRAP WITH BOTH HANDS AND REMOVE THEODOLITE, IN ITS CARRYING CASE, FROM THE SHIPPING CASE.

EMC 6675-232-15/6

Figure 6. Theodolite in shipping case, removal and installation.

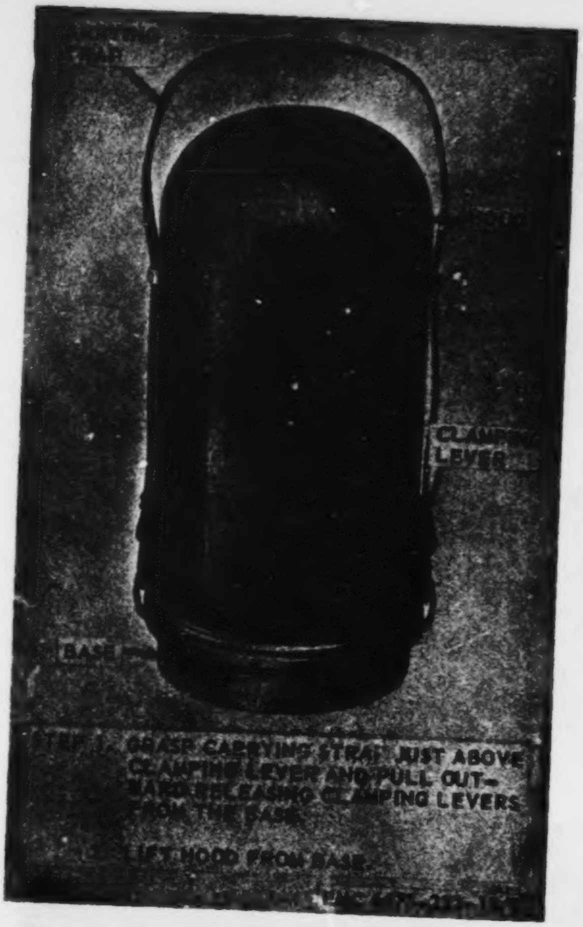

CARRYING STRAP
CLAMPING LEVER
BASE
STEP 1. GRASP CARRYING STRAP JUST ABOVE CLAMPING LEVER AND PULL OUTWARD RELEASING CLAMPING LEVERS FROM THE BASE.
LIFT HOOD FROM BASE.

Figure 7. Theodolite carrying case hood, removal and installation.

that is pink in color can be dehydrated in an oven. If replacement of desiccant is necessary, refer to paragraph 55.

(5) Test the three leveling screws (fig. 1) for rough travel. They should turn easily with thumb and finger pressure, but should be tight enough to hold the instrument in any position.

(6) See that the horizontal slow-motion screw (fig. 1) and vertical slow-motion screw (fig. 3) turn smoothly and easily without play throughout their full travel.

(7) Inspect the horizontal clamp (fig. 1), vertical clamp (fig. 1), and horizontal circle clamp (fig. 2) for improper operation.

(8) Inspect the optical lenses of the intrument for finger marks, dust, scratches, and etching. Remove any dust with the camel's-hair brush. If breathing on the glass and wiping with the chamois does not adequately clean the lenses, use lens tissue and grain alcohol or acetone for cleaning.

Caution: **Do not use acetone on plastic material.**

(9) Inspect the tribrach clamp level (fig. 4) for improper functioning. It should have enough tension to lock the theodolite to the tribrach assembly.

(10) Inspect the illumination mirror (fig. 2) for improper positioning on the instrument. It should rotate easily but should be tight enough to stay in any desired position.

(11) Inspect the circular level (fig. 1), plate level (fig. 1), and collimation level mirror (fig. 3) for cracks, breakage, and looseness.

(12) Inspect the focusing tube (fig. 1) for improper functioning and roughness of travel. There must not be any perceptible end play.

(13) Inspect the reticle mirror knob (fig. 1) for lack of smoothness in turning through its travel. When the line on the top of the mirror knob is parallel to the telescope axis, the mirror does not obstruct daylight from the reticle. When using electrical illumination, turning the knob counterclockwise from the parallel position permits light to fall on the reticle.

b. Tripod Assembly.

(1) Inspect the tripod assembly (fig. 10) for damaged or missing tripod head cover, damaged legs, and cut or broken leather strap.

(2) Inspect the cover bracket and battery box bracket for insecure mounting.

(3) Unbuckle the leather strap and open the tripod legs to permit access to the tripod accessory case. Inspect the case for insecure mounting to the tri-

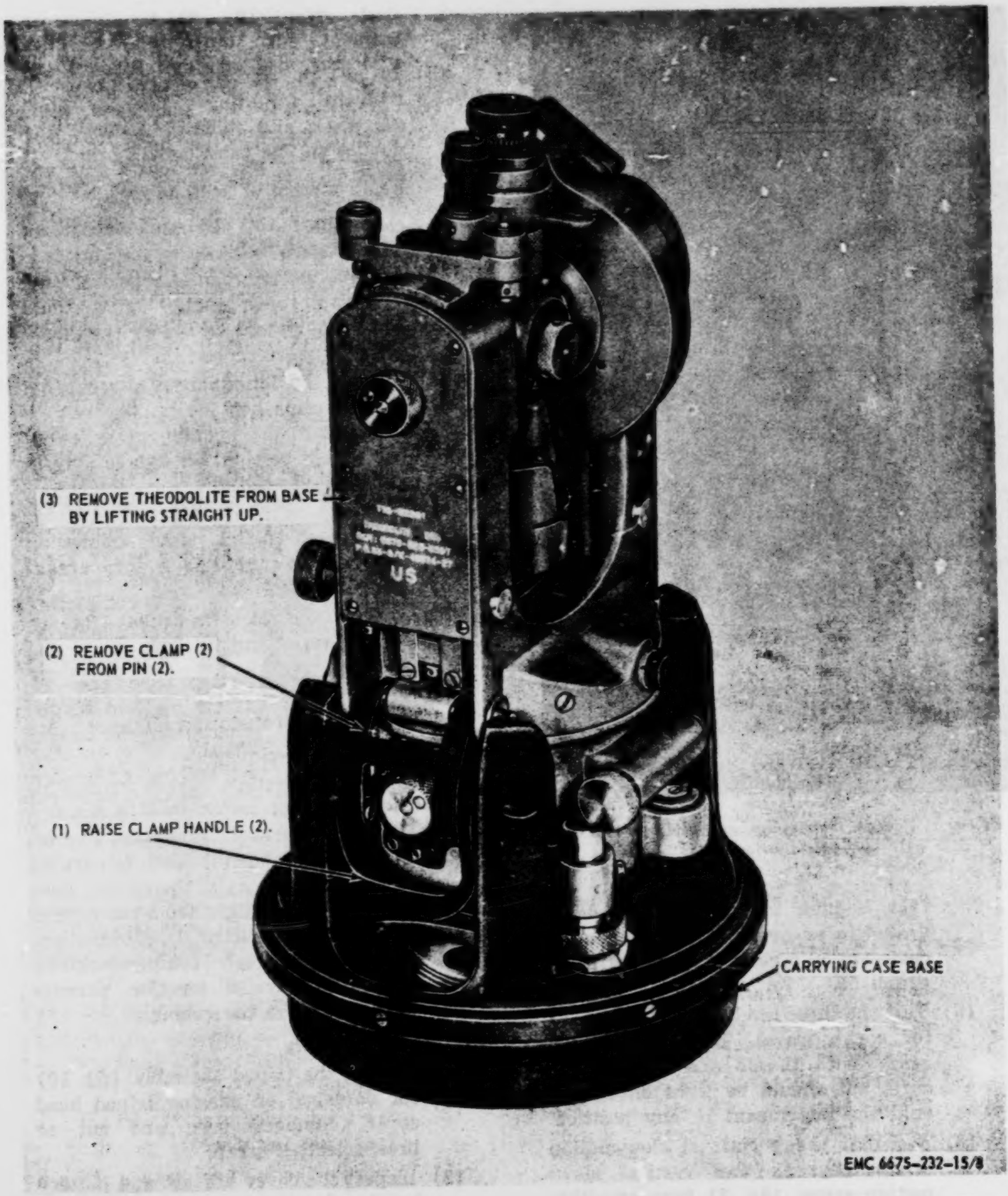

(3) REMOVE THEODOLITE FROM BASE BY LIFTING STRAIGHT UP.
US
(2) REMOVE CLAMP (2) FROM PIN (2).
(1) RAISE CLAMP HANDLE (2).
CARRYING CASE BASE
EMC 6675-232-15/8

Figure 8. Theodolite base, removal and installation.

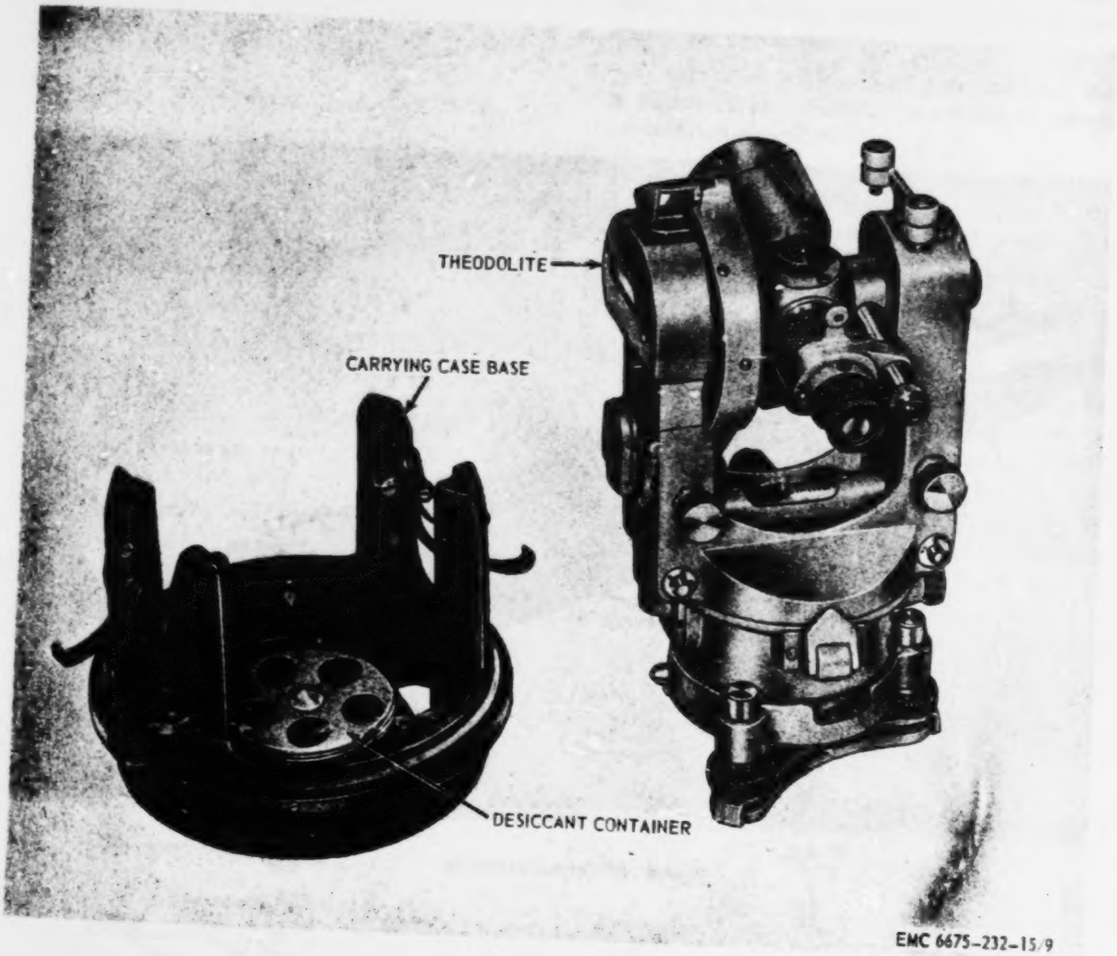

THEODOLITE
CARRYING CASE BASE
DESICCANT CONTAINER
EMC 6675-232-15/9

Figure 9. Theodolite and desiccant container with base removed.

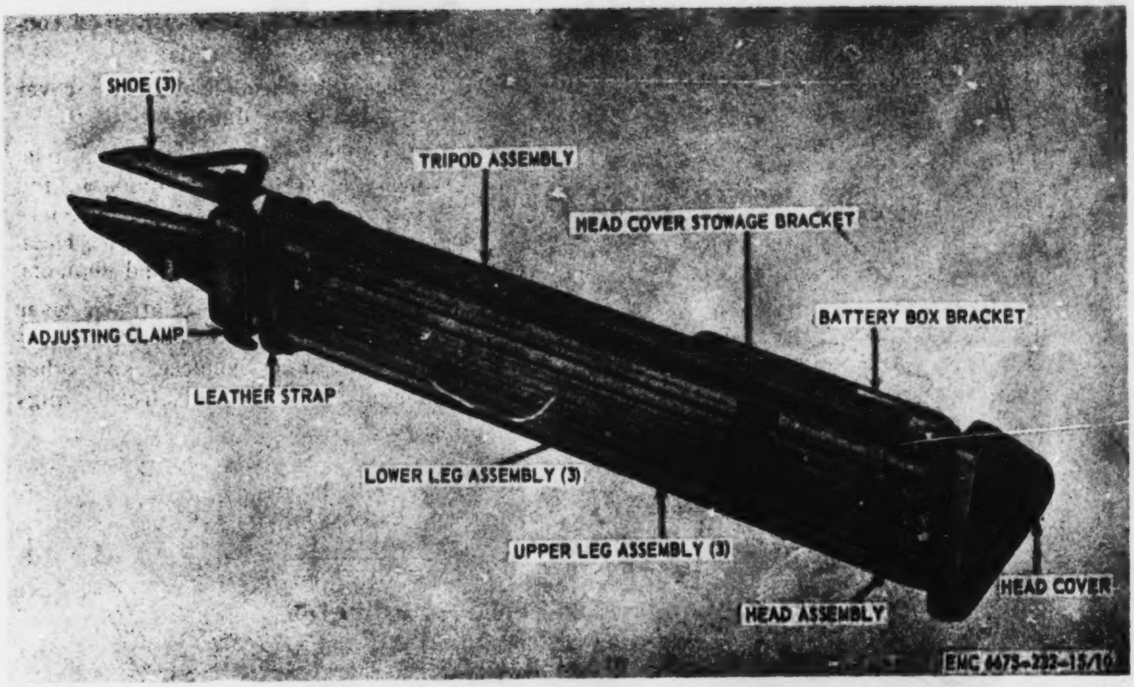

SHOE (3)
TRIPOD ASSEMBLY
HEAD COVER STOWAGE BRACKET
BATTERY BOX BRACKET
ADJUSTING CLAMP
LEATHER STRAP
LOWER LEG ASSEMBLY (3)
UPPER LEG ASSEMBLY (3)
HEAD COVER
HEAD ASSEMBLY
ENC 6675-232-15/10

Figure 10. Tripod assembly.

pod, torn seams, and loose or missing fastener. Make sure the case contains a tripod wrench and plumb bob assembly (fig. 11).

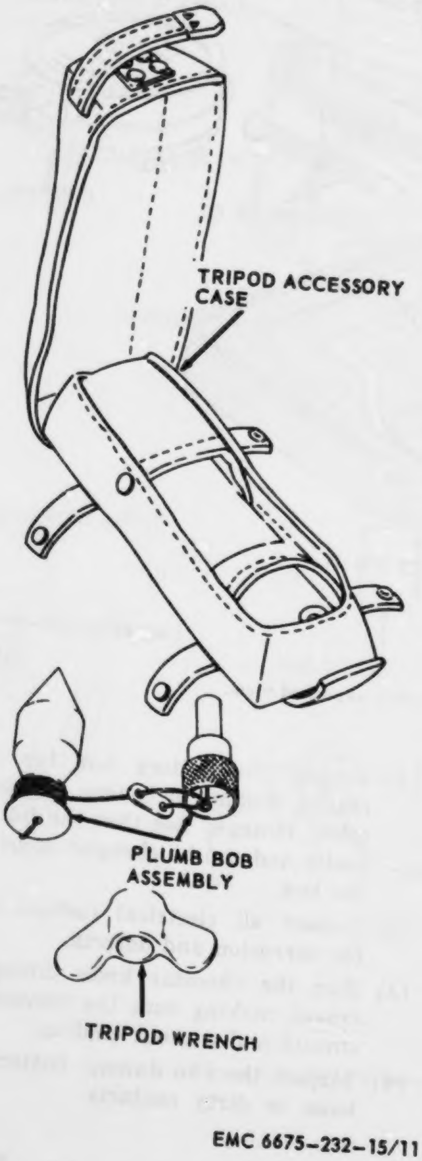


Figure 11. Tripod accessory case and accessories, unpacked view.

(4) Correct or report all deficiencies to field maintenance.

c. Canvas Field Pack. Inspect the canvas field pack (fig. 12) for rips, tears, missing straps, and broken buckles. Correct all deficiencies as necessary.

d. Accessory Case and Accessories. Refer to figure 13 and inspect the accessory case and accessories as follows:

(1) Inspect the accessory case for rips, defective zipper, and other damage. Make sure all inside pockets, flaps, and retaining loops are in good condition.

(2) Inspect the theodolite plastic cover and chamois for damage.

(3) Inspect the two eyepiece prisms, telescope eyepiece prism, sunglass, and telescope lens for dirty and defective glass. If the glasses are dirty, clean with camel's-hair brush and chamois.

(4) Inspect the compass for broken cover glass, loose or missing hardware, broken or missing eyepiece, and other damage. See that the circle swings

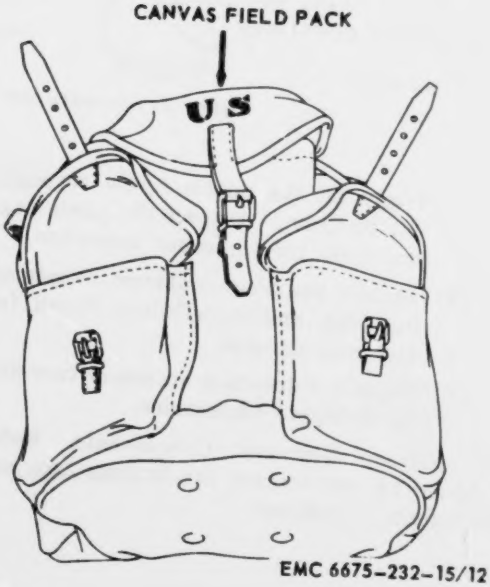
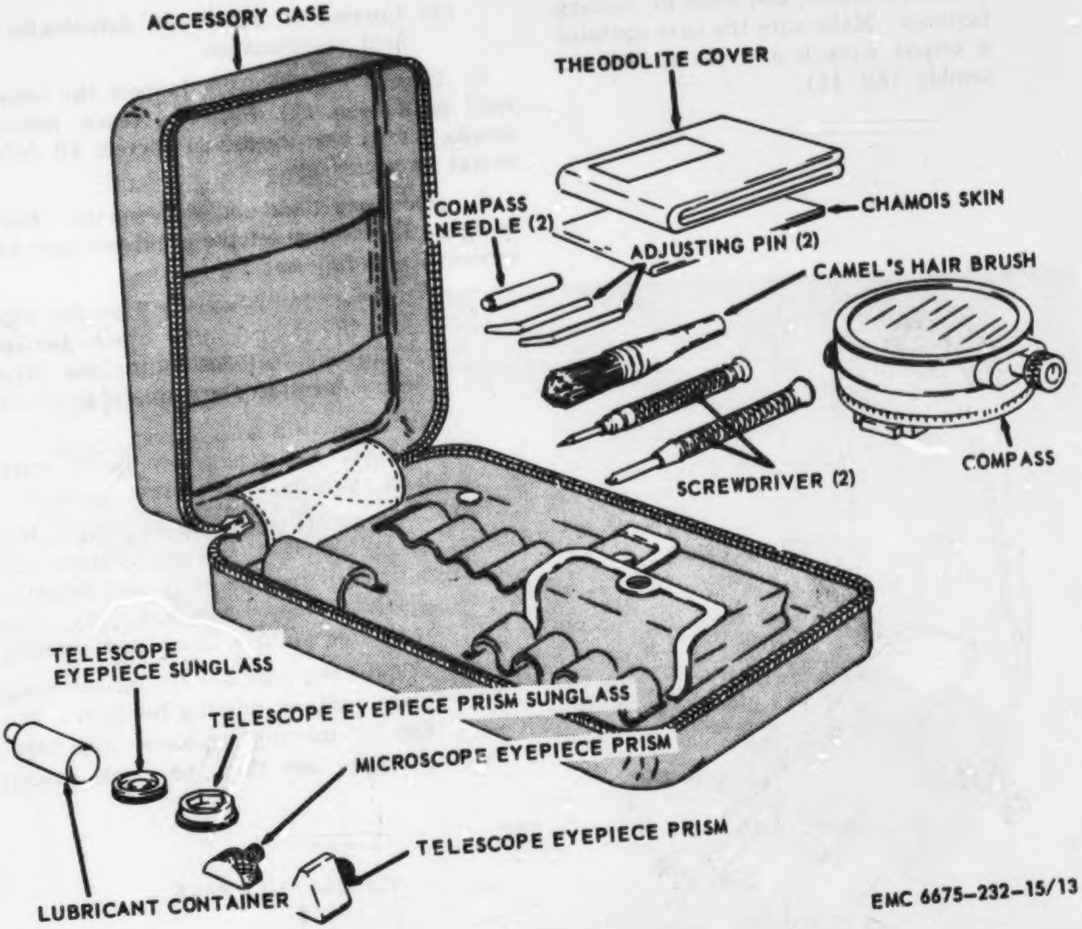


Figure 12. Canvas field pack.


ACCESSORY CASE
THEODOLITE COVER
CHAMOIS SKIN
COMPASS NEEDLE (2)
ADJUSTING PIN (2)
CAMEL'S HAIR BRUSH
COMPASS
SCREWDRIVER (2)
TELESCOPE EYEPIECE SUNGLASS
TELESCOPE EYEPIECE PRISM SUNGLASS
MICROSCOPE EYEPIECE PRISM
TELESCOPE EYEPIECE PRISM
LUBRICANT CONTAINER

EMC 6675-232-15/13

Figure 13. Accessory case and accessories, unpacked view.

freely on the needle screw throughout its travel. Inspect the circle caging knob for improper operation.

(5) Inspect the 2 screwdrivers, 2 adjusting pins, and camel's-hair brush for dirt and damage.

(6) Replace a defective accessory case and all defective accessories.

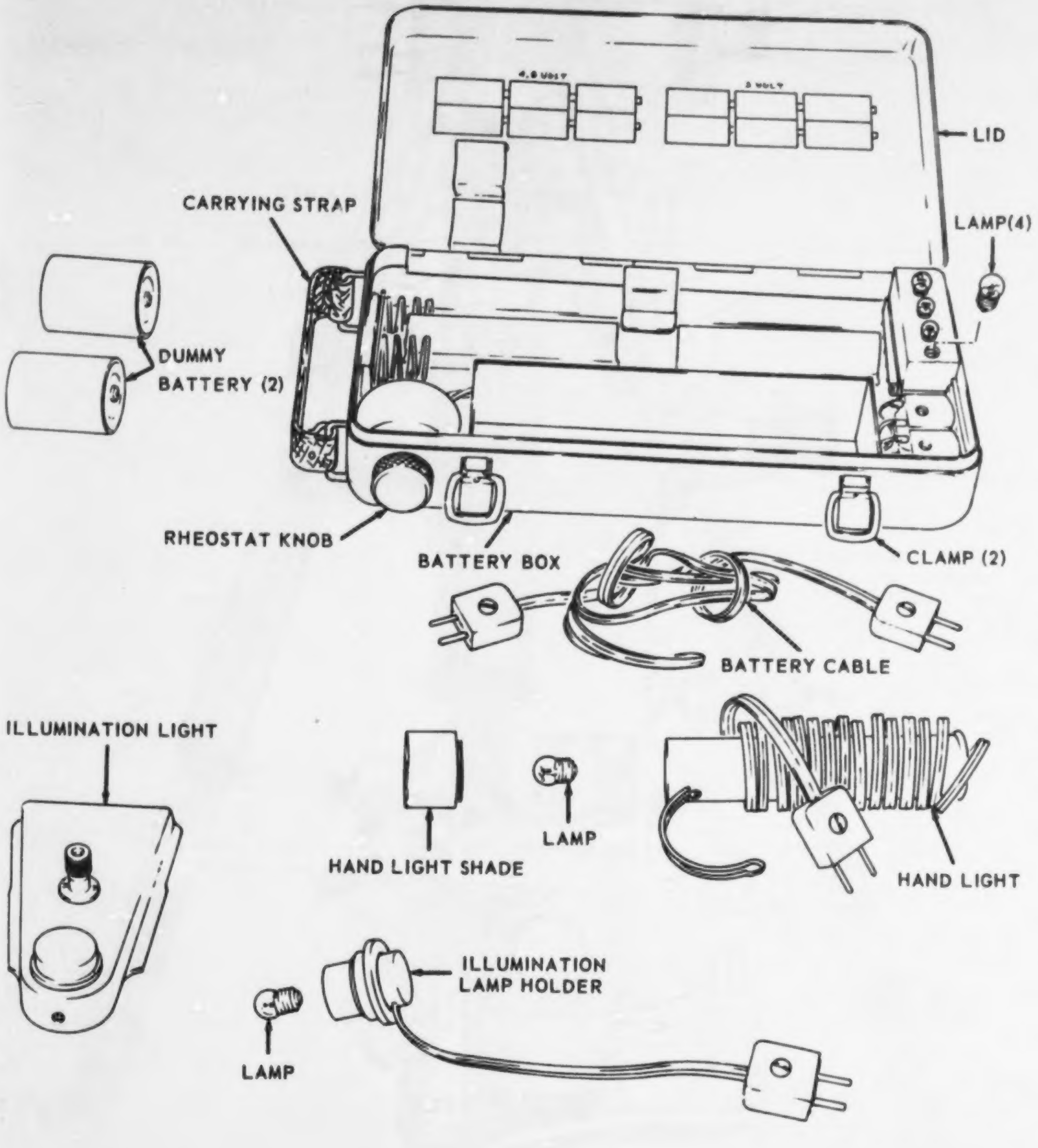
e. Battery Box and Components. Refer to figure 14 and inspect the battery box and components as follows:

(1) Inspect the battery box for dents, cracks, missing or broken clamps, and other damage. See that the lid closes easily and can be clamped securely to the box.

(2) Inspect all electrical contact points for corrosion and defects.

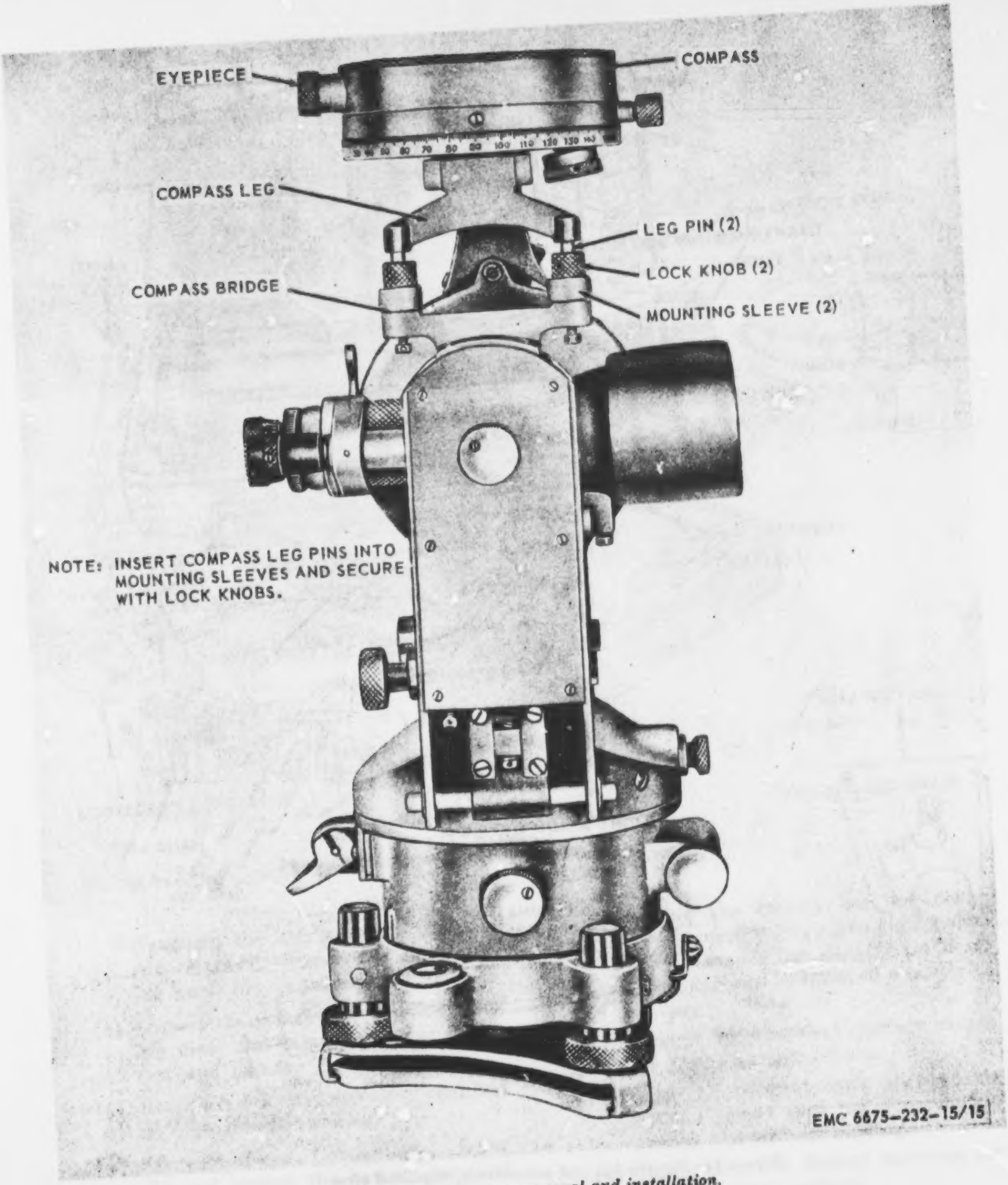
(3) Run the rheostat knob through its travel, making sure the movement is smooth and without binding.

(4) Inspect the two dummy batteries for loose or dirty contacts.


LID
CARRYING STRAP
LAMP(4)
DUMMY BATTERY (2)
RHEOSTAT KNOB
BATTERY BOX
CLAMP (2)
BATTERY CABLE
ILLUMINATION LIGHT
HAND LIGHT SHADE
LAMP
HAND LIGHT
ILLUMINATION LAMP HOLDER
LAMP

EMC 6675-232-15/14

Figure 14. Battery box and components, unpacked view.


EYEPIECE
COMPASS
COMPASS LEG
LEG PIN (2)
LOCK KNOB (2)
COMPASS BRIDGE
MOUNTING SLEEVE (2)
EMC 6675-232-15/15

NOTE: INSERT COMPASS LEG PINS INTO MOUNTING SLEEVES AND SECURE WITH LOCK KNOBS.

Figure 15. Compass, removal and installation.

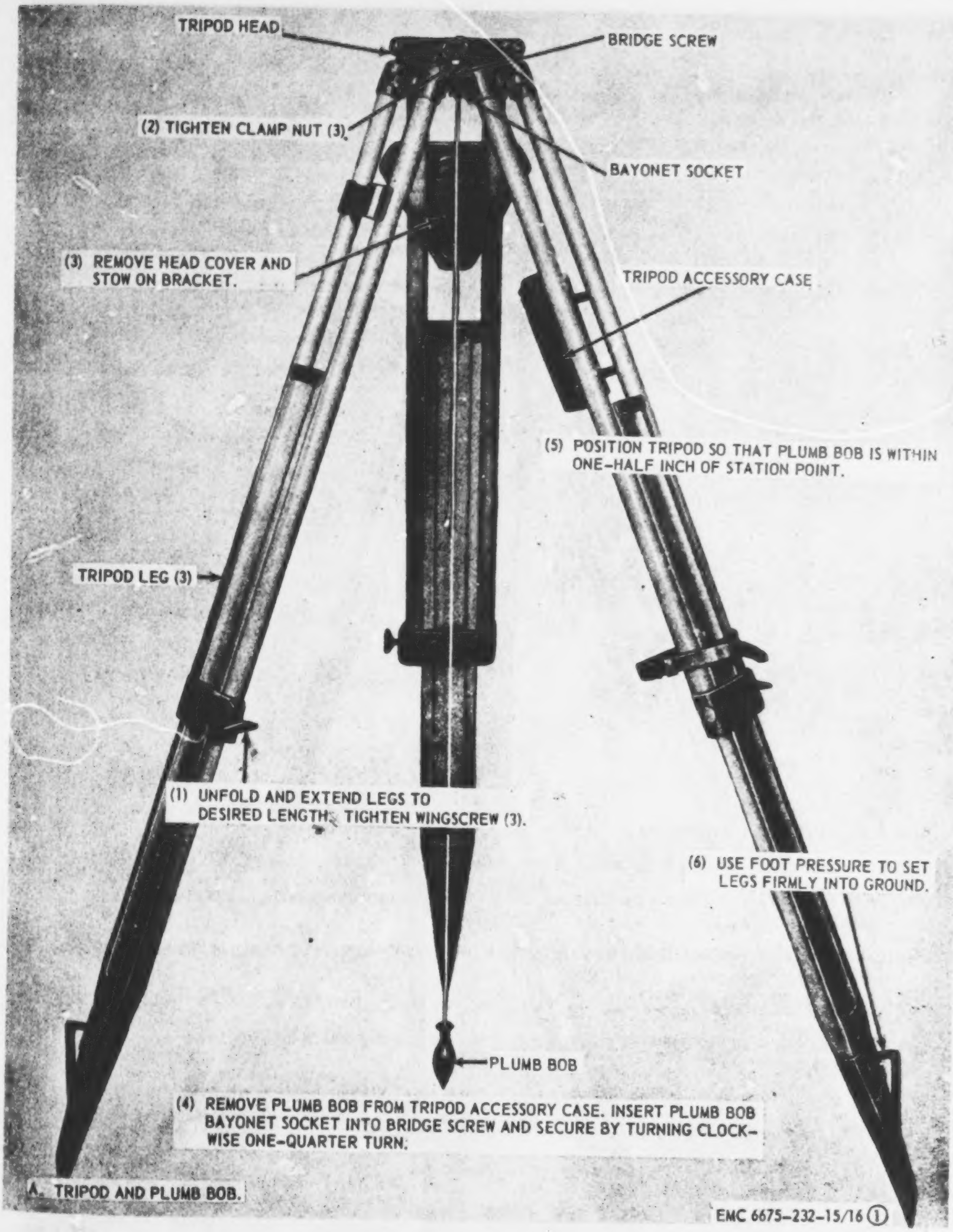
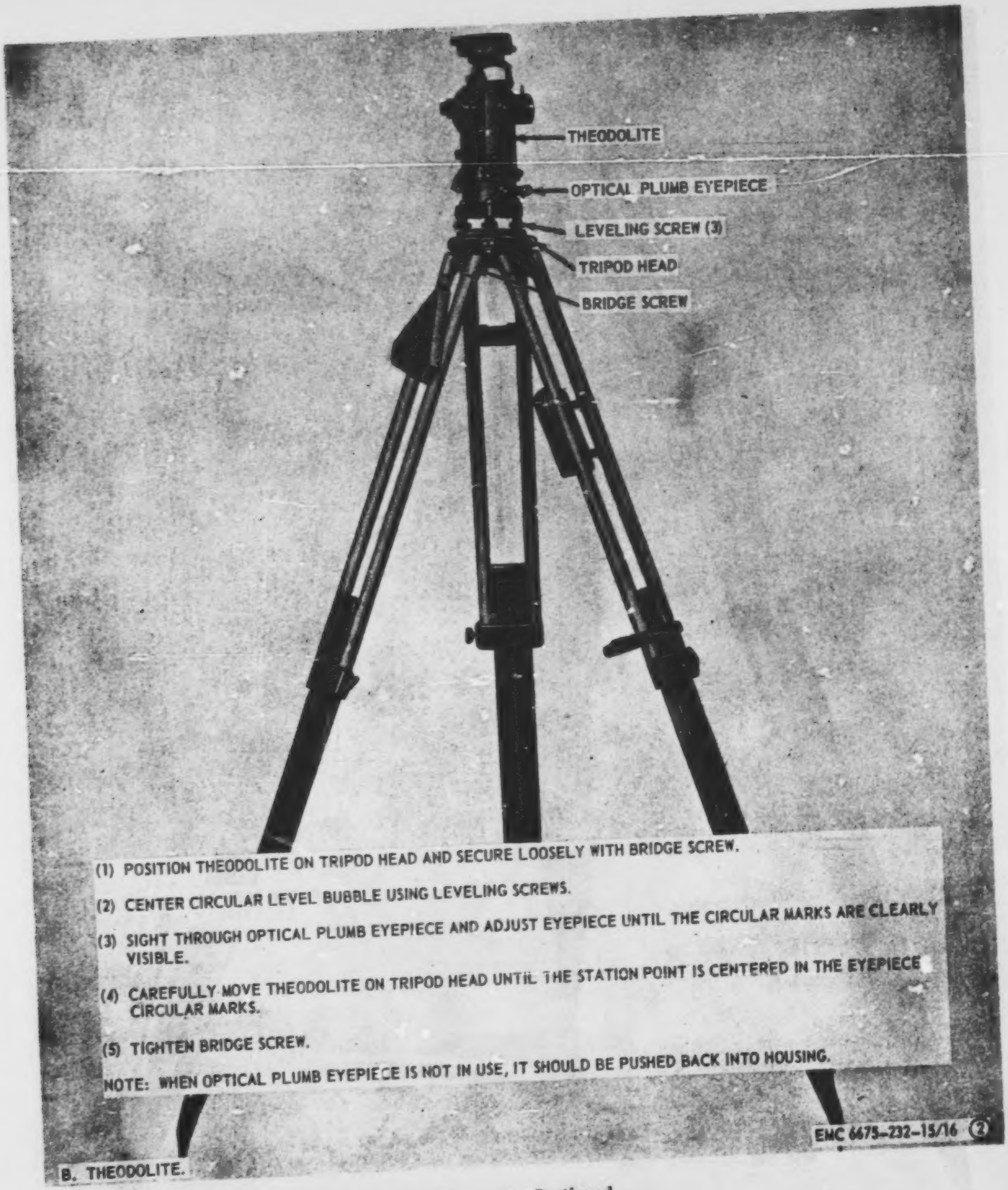

TRIPOD HEAD
BRIDGE SCREW
(2) TIGHTEN CLAMP NUT (3).
BAYONET SOCKET
(3) REMOVE HEAD COVER AND STOW ON BRACKET.
TRIPOD ACCESSORY CASE
(5) POSITION TRIPOD SO THAT PLUMB BOB IS WITHIN ONE-HALF INCH OF STATION POINT.
TRIPOD LEG (3)
(1) UNFOLD AND EXTEND LEGS TO DESIRED LENGTH; TIGHTEN WINGSCREW (3).
(6) USE FOOT PRESSURE TO SET LEGS FIRMLY INTO GROUND.
PLUMB BOB
(4) REMOVE PLUMB BOB FROM TRIPOD ACCESSORY CASE. INSERT PLUMB BOB BAYONET SOCKET INTO BRIDGE SCREW AND SECURE BY TURNING CLOCKWISE ONE-QUARTER TURN.
A. TRIPOD AND PLUMB BOB.
EMC 6675-232-15/16 ①

Figure 16. Tripod, plumb bob, and theodolite, removal and installation.


THEODOLITE
OPTICAL PLUMB EYEPIECE
LEVELING SCREW (3)
TRIPOD HEAD
BRIDGE SCREW

(1) POSITION THEODOLITE ON TRIPOD HEAD AND SECURE LOOSELY WITH BRIDGE SCREW.

(2) CENTER CIRCULAR LEVEL BUBBLE USING LEVELING SCREWS.

(3) SIGHT THROUGH OPTICAL PLUMB EYEPIECE AND ADJUST EYEPIECE UNTIL THE CIRCULAR MARKS ARE CLEARLY VISIBLE.

(4) CAREFULLY MOVE THEODOLITE ON TRIPOD HEAD UNTIL THE STATION POINT IS CENTERED IN THE EYEPIECE CIRCULAR MARKS.

(5) TIGHTEN BRIDGE SCREW.

NOTE: WHEN OPTICAL PLUMB EYEPIECE IS NOT IN USE, IT SHOULD BE PUSHED BACK INTO HOUSING.

EMC 6675-232-15/16 ②

B. THEODOLITE.

Figure 16—Continued.

(5) See that the four spare lamps are secure in the mounting holes and in good condition.

(6) Inspect the hand light and battery cable for defective wiring and connector plugs. Inspect the hand light for a cracked or broken case, defective lamp, or damaged switch.

Note. The four batteries are not issued with the battery box.

(7) Inspect the plug-in illumination lamp holder assembly for defective wiring, lamp, or connector plug.

(8) Replace all parts found to be defective.

9. Installation of Separately Packed Components

a. General. The compass is carried in the accessory case, since there is not enough room in the hood for it to be left mounted on the theodolite.

b. Compass.

(1) Remove the compass from the accessory case (par 8).

(2) Unfold the compass legs from the closed position.

(3) Refer to figure 15 and install the compass.

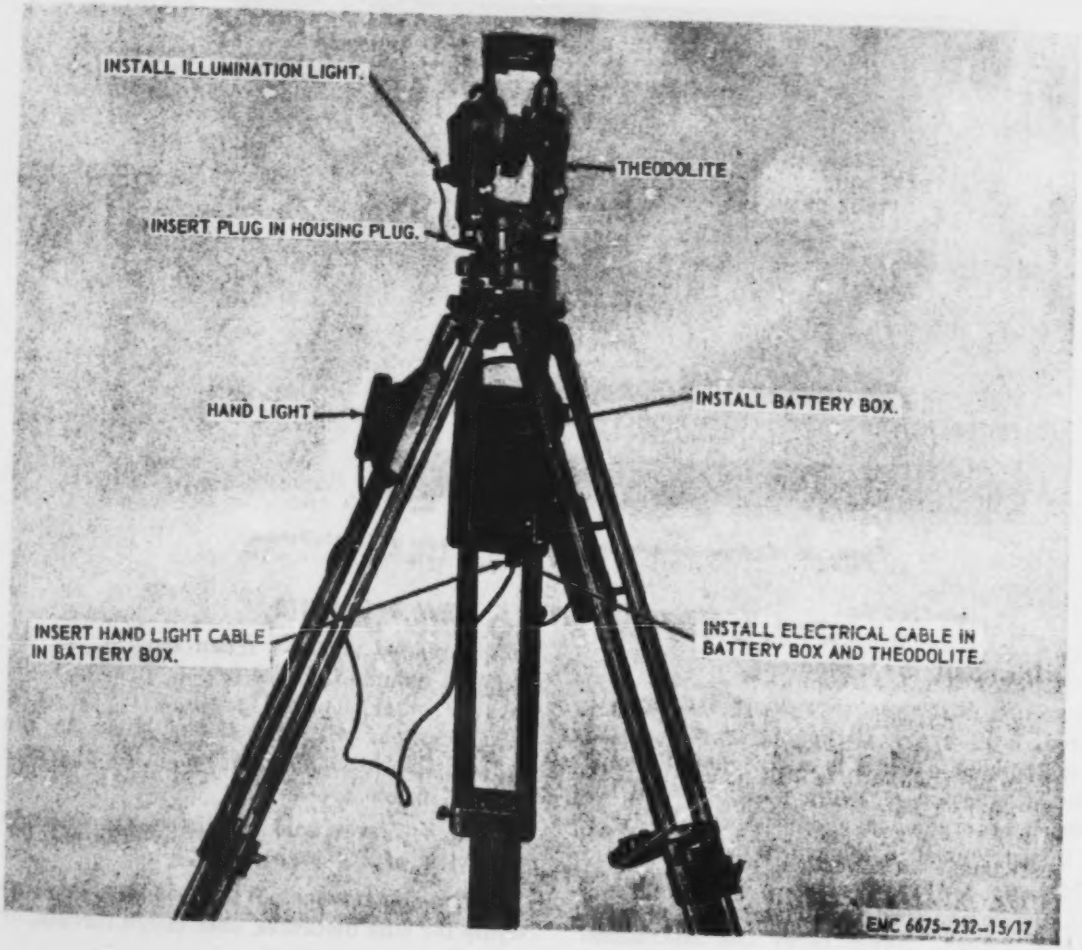

INSTALL ILLUMINATION LIGHT.
THEODOLITE
INSERT PLUG IN HOUSING PLUG.
HAND LIGHT
INSTALL BATTERY BOX.
INSERT HAND LIGHT CABLE IN BATTERY BOX.
INSTALL ELECTRICAL CABLE IN BATTERY BOX AND THEODOLITE.
EMC 6675-232-15/17

Figure 17. Illumination system, removal and installation.

10. Installation or Setting-Up Instructions

a. Tripod. Refer to figure 16 and erect the tripod over the station point and install the plumb bob.

b. Theodolite.

(1) Remove the theodolite from carrying case (par. 7).

(2) Refer to figure 16 and install the theodolite on the tripod.

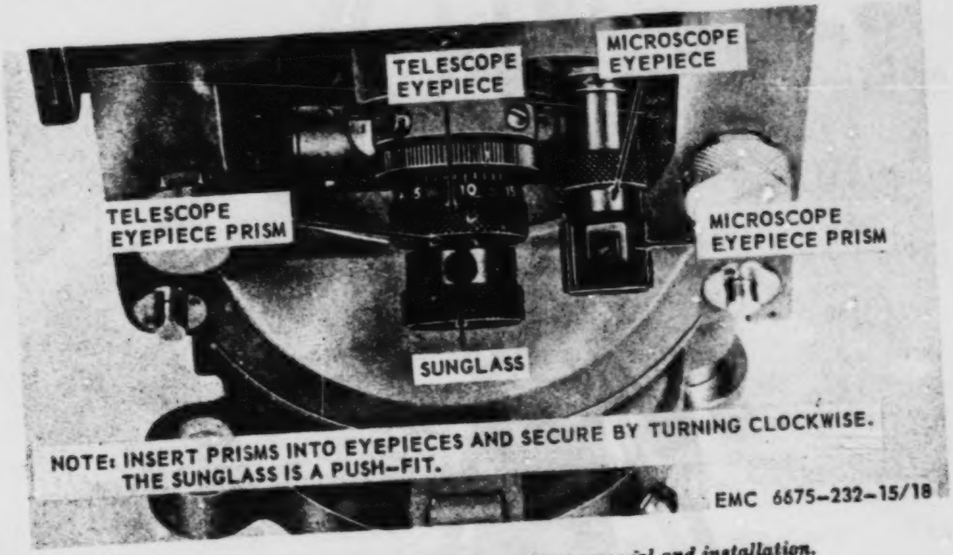
11. Equipment Conversion

a. General. The theodolite is equipped for normal daytime operation as it comes from the carrying case. However, for dark-day or night operation it will be necessary to install the illumination system. For high vertical-angle observations, use the eyepiece prisms and sunglass.

b. Night or Dark-Day Operations. To adapt the theodolite for use on dark days or at night, refer to figure 17 and install the illumination system.

c. High Vertical Angle Observations. To sight vertical angles up to 65° from horizontal, install the telescope and microscope eyepiece prisms and, if needed, the sunglass, as shown in figure 18.

***Warning:* Severe eye injury can result from neglecting the use of the sunglass when looking into direct sunlight.**



NOTE: INSERT PRISMS INTO EYEPIECES AND SECURE BY TURNING CLOCKWISE. THE SUNGLASS IS A PUSH-FIT.

EMC 6675-232-15/18

Figure 18. Eyepiece prisms and sunglass, removal and installation.

Section II. MOVEMENT TO A NEW WORKSITE

12. Dismantling for Movement

a. Short Distances. For short distances in cleared, level areas, the operator may carry the instrument while it is still mounted on the tripod. Correct carrying position is with the tripod head cradled against the shoulder and the instrument in a vertical position.

***Caution:* Always secure the horizontal, vertical, and compass circle clamps before moving the instrument. Never carry the instrument over the shoulder.**

b. Confined Areas. When moving the instrument mounted on the tripod through doorways or other confined areas, carry it in a tilted position, with the tripod shoes to the rear and the theodolite in front of the operator and well below eye level.

***Caution:* Never hold the theodolite so as to block view of the path ahead.**

c. Long Distances. When moving the theodolite for long distances, over rough terrain, or at night, return it to the carrying case for maximum safety to the instrument.

Caution: **Exercise extreme care to avoid dropping the instrument. If the carrying case is accidentally dropped, the instrument should be thoroughly inspected for damage and readjusted if necessary.**

13. Reinstallation After Movement

After movement to a new worksite, install the theodolite as outlined in paragraph 10.

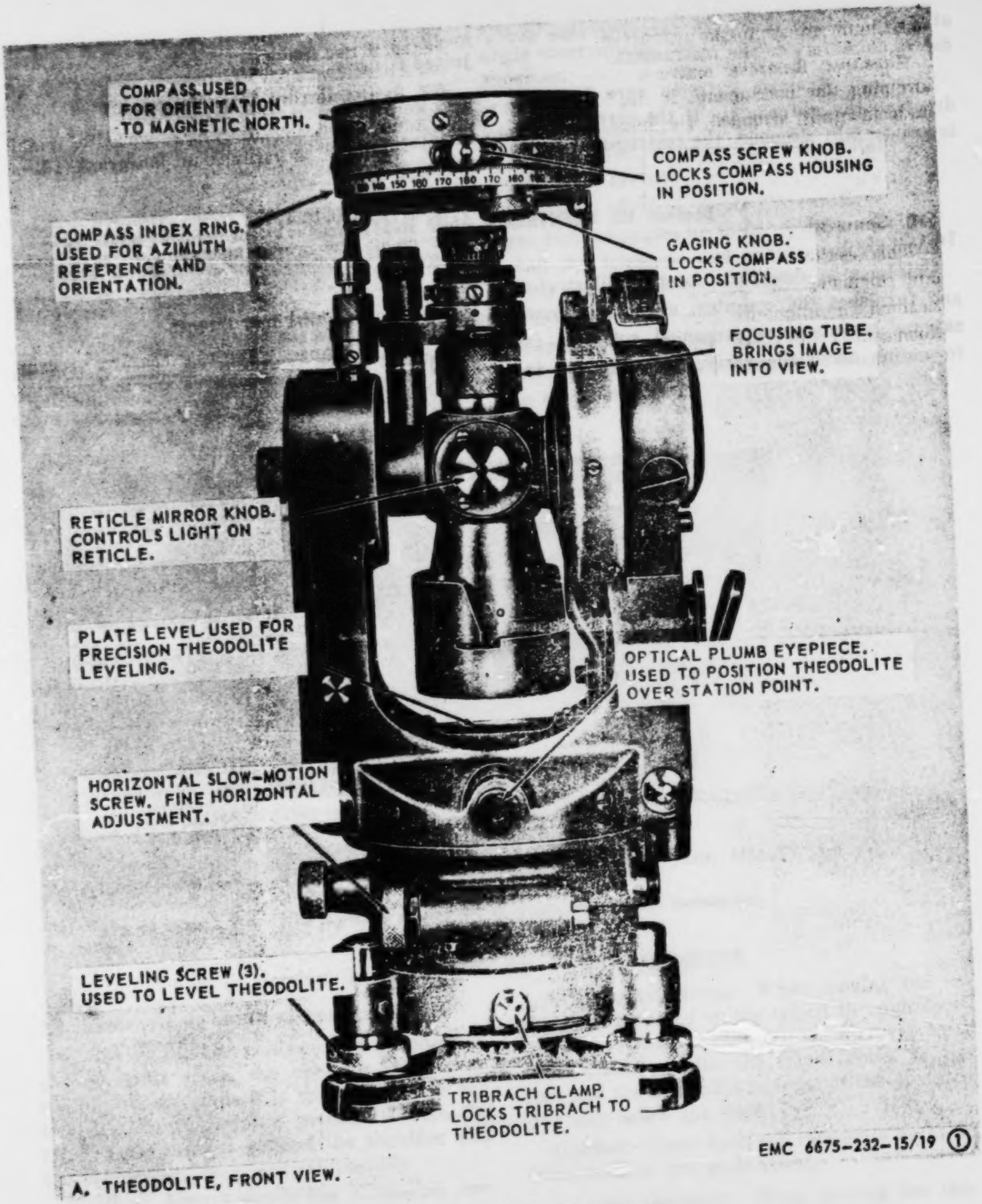
Section III. CONTROLS AND INSTRUMENTS

14. General

This section describes, locates, illlustrates, and furnishes the operator, crew, or organizational maintenance personnel sufficient information about the various controls and instruments for proper operation of the theodolite.

15. Controls and Instruments

Refer to figure 19 for the location, description, and function of controls and instruments.


COMPASS USED FOR ORIENTATION TO MAGNETIC NORTH.
COMPASS SCREW KNOB. LOCKS COMPASS HOUSING IN POSITION.
COMPASS INDEX RING. USED FOR AZIMUTH REFERENCE AND ORIENTATION.
GAGING KNOB. LOCKS COMPASS IN POSITION.
FOCUSING TUBE. BRINGS IMAGE INTO VIEW.
RETICLE MIRROR KNOB. CONTROLS LIGHT ON RETICLE.
PLATE LEVEL USED FOR PRECISION THEODOLITE LEVELING.
OPTICAL PLUMB EYEPIECE. USED TO POSITION THEODOLITE OVER STATION POINT.
HORIZONTAL SLOW-MOTION SCREW. FINE HORIZONTAL ADJUSTMENT.
LEVELING SCREW (3). USED TO LEVEL THEODOLITE.
TRIBRACH CLAMP. LOCKS TRIBRACH TO THEODOLITE.
EMC 6675-232-15/19 ①

A. THEODOLITE, FRONT VIEW.

Figure 19. Controls and instruments.

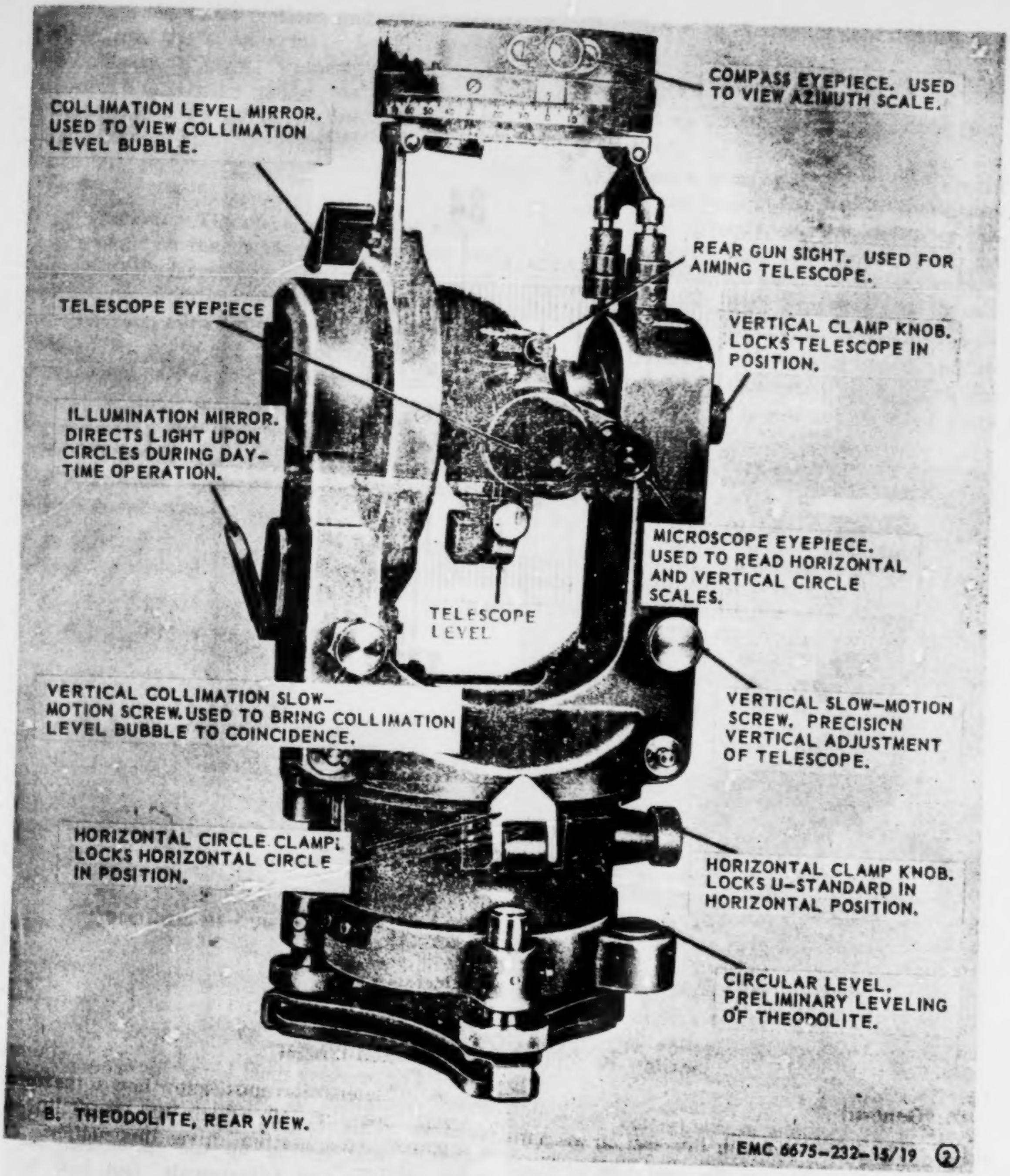
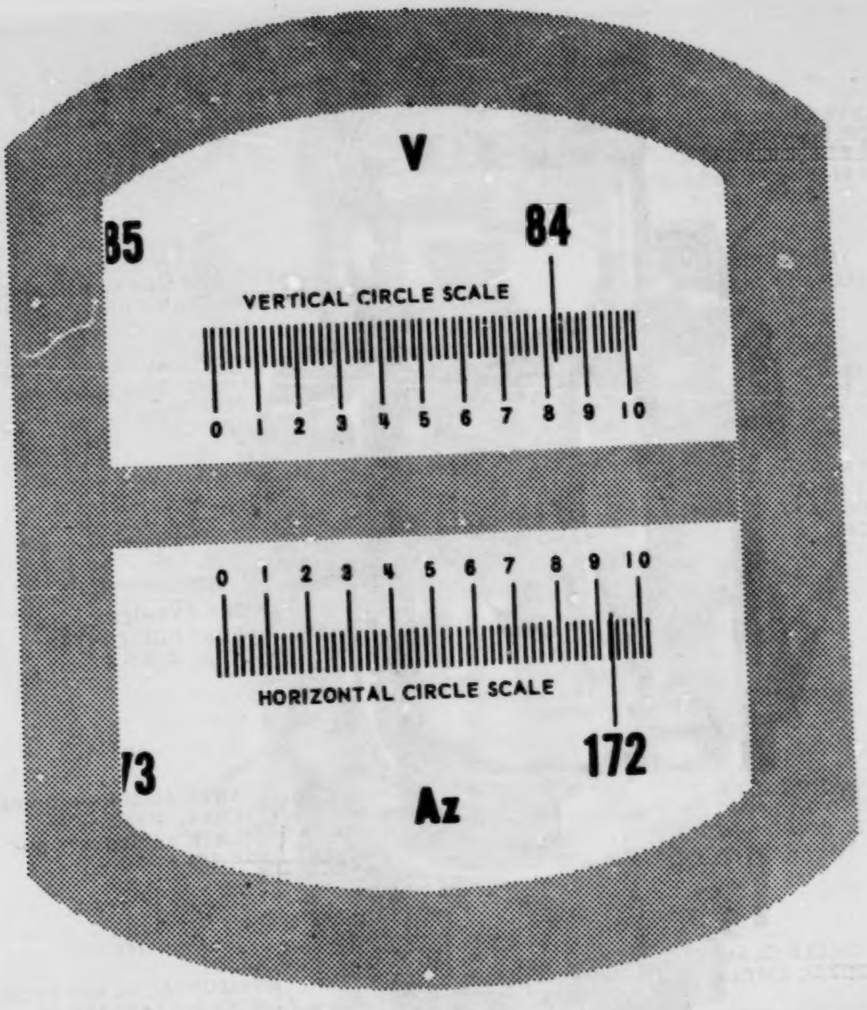

COMPASS EYEPIECE. USED TO VIEW AZIMUTH SCALE.
COLLIMATION LEVEL MIRROR. USED TO VIEW COLLIMATION LEVEL BUBBLE.
REAR GUN SIGHT. USED FOR AIMING TELESCOPE.
TELESCOPE EYEPIECE
VERTICAL CLAMP KNOB. LOCKS TELESCOPE IN POSITION.
ILLUMINATION MIRROR. DIRECTS LIGHT UPON CIRCLES DURING DAY-TIME OPERATION.
MICROSCOPE EYEPIECE. USED TO READ HORIZONTAL AND VERTICAL CIRCLE SCALES.
TELESCOPE LEVEL
VERTICAL COLLIMATION SLOW-MOTION SCREW. USED TO BRING COLLIMATION LEVEL BUBBLE TO COINCIDENCE.
VERTICAL SLOW-MOTION SCREW. PRECISION VERTICAL ADJUSTMENT OF TELESCOPE.
HORIZONTAL CIRCLE CLAMP. LOCKS HORIZONTAL CIRCLE IN POSITION.
HORIZONTAL CLAMP KNOB. LOCKS U-STANDARD IN HORIZONTAL POSITION.
CIRCULAR LEVEL. PRELIMINARY LEVELING OF THEODOLITE.
B. THEODOLITE, REAR VIEW.
EMC 6675-232-15/19 ②

Figure 19—Continued.


V
85
84
VERTICAL CIRCLE SCALE
0 1 2 3 4 5 6 7 8 9 10
0 1 2 3 4 5 6 7 8 9 10
HORIZONTAL CIRCLE SCALE
73
172
Az

EMC 6675-232-15/19 ③

Figure 19—Continued.

Section IV. OPERATION OF EQUIPMENT

16. General

a. The instructions in this section are published for the information and guidance of the personnel responsible for the operation of the theodolite.

b. The operator must know how to perform every operation of which the theodolite is capable. This section gives instructions on handling and setting up the theodolite, the basic motions and adjustments, and how to coordinate the basic motions and adjustments to perform the specific tasks for which the theodolite is designed. Since nearly every job presents a different problem, the operator may have to vary the given procedure to fit the individual job.

17. Adjustments

a. General. There are two types of adjustments made on the theodolite: instrument and operational adjustments. Instrument adjustments bring the theodolite into proper operating condition with respect to the interrelationship of its parts and are not normally made in the field. Operation adjustments bring the theodolite into proper relationship with the terrain being surveyed and are required each time the theodolite is set up for actual surveying operations. This paragraph covers instrument adjustments.

b. Circular Level. Refer to figure 20 and adjust the circular level.

c. Plate Level.

(1) Level the theodolite (par. 18)

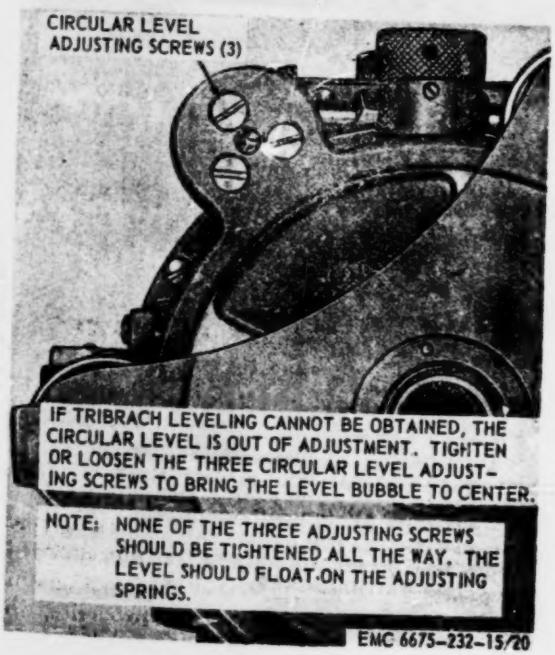
(2) Refer to figure 21 and adjust the plate level.

d. Optical Plumb.

(1) Set up the tripod and theodolite (par. 10).

(2) Place a cross or other distinctive mark on the ground and center the instrument directly over it. Observe this mark through the optical plumb device eyepiece and move the instrument until the ground mark is exactly centered in the microscope.

(3) Unlock the horizontal clamp and rotate the U-standard 180° Lock the clamp. If the microscope circle mark



IF TRIBRACH LEVELING CANNOT BE OBTAINED, THE CIRCULAR LEVEL IS OUT OF ADJUSTMENT. TIGHTEN OR LOOSEN THE THREE CIRCULAR LEVEL ADJUSTING SCREWS TO BRING THE LEVEL BUBBLE TO CENTER.

NOTE: NONE OF THE THREE ADJUSTING SCREWS SHOULD BE TIGHTENED ALL THE WAY. THE LEVEL SHOULD FLOAT ON THE ADJUSTING SPRINGS.

EMC 6675-232-15/20

Figure 20. Circular level adjustment.

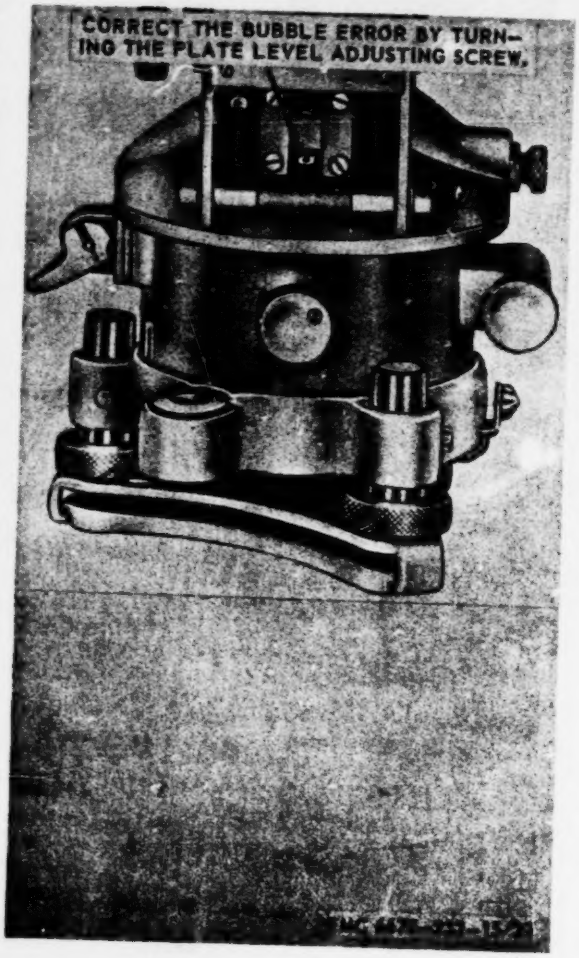

CORRECT THE BUBBLE ERROR BY TURNING THE PLATE LEVEL ADJUSTING SCREW.

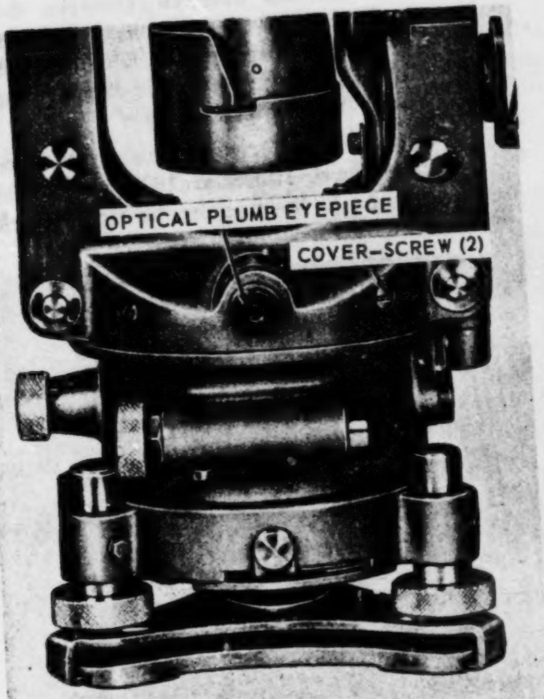
Figure 21. Plate level adjustment.

has moved, loosen the tripod head bridge screw and move the theodolite toward the ground mark one-half the displacement.

(4) Refer to figure 22 and adjust the optical plumb device.

e. Collimation Slow-Motion Screw. Refer to figure 23 and adjust the collimation slow-motion screw.

f. Vertical Slow-Motion Screw. Refer to figure 24 and adjust the vertical slow-motion screw.


OPTICAL PLUMB EYEPIECE
COVER-SCREW (2)

STEP 1. REMOVE COVER SCREWS.

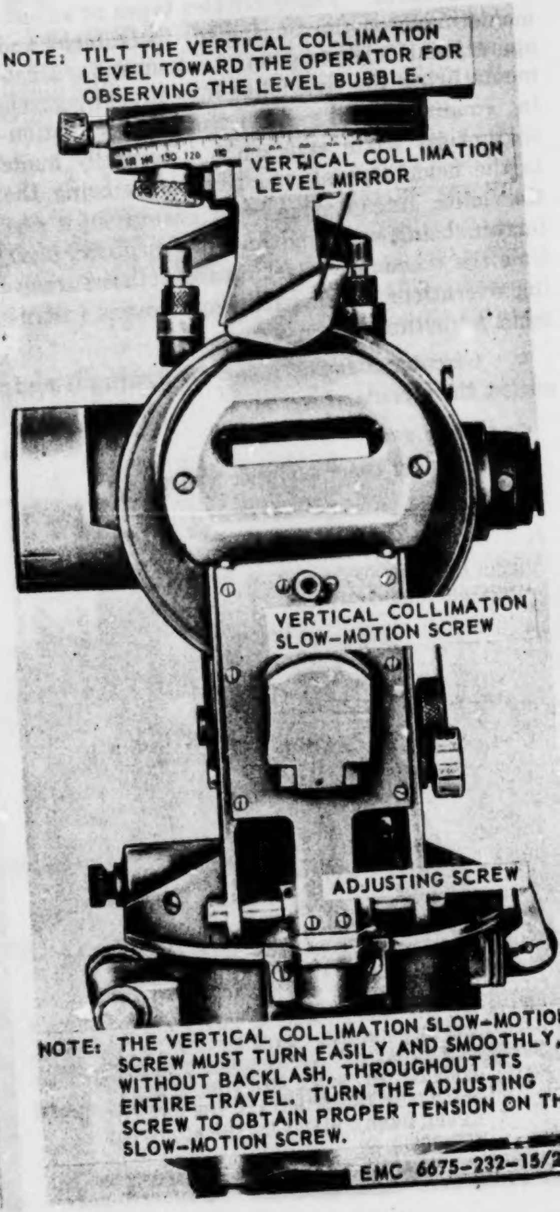
STEP 2. INSERT SCREWDRIVER IN COVER-SCREW HOLES AND TURN ADJUSTING SCREWS TO ADJUST EYEPIECE CIRCULAR MARKS OVER THE GROUND POINT.

NOTE: THE LAST MOVEMENT OF THE ADJUSTING SCREWS SHOULD BE CLOCKWISE TO MAINTAIN PRESSURE AGAINST THE COUNTER SPRINGS.

STEP 3. INSTALL THE COVER SCREWS.

EMC 6675-232-15/22

Figure 22. Optical plumb device adjustment.

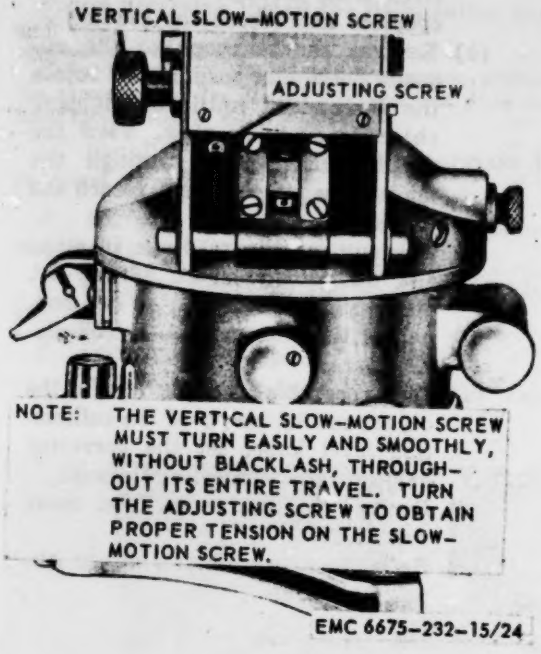

NOTE: TILT THE VERTICAL COLLIMATION LEVEL TOWARD THE OPERATOR FOR OBSERVING THE LEVEL BUBBLE.

VERTICAL COLLIMATION LEVEL MIRROR
VERTICAL COLLIMATION SLOW-MOTION SCREW
ADJUSTING SCREW

NOTE: THE VERTICAL COLLIMATION SLOW-MOTIO SCREW MUST TURN EASILY AND SMOOTHLY, WITHOUT BACKLASH, THROUGHOUT ITS ENTIRE TRAVEL. TURN THE ADJUSTING SCREW TO OBTAIN PROPER TENSION ON TH SLOW-MOTION SCREW.

EMC 6675-232-15/2

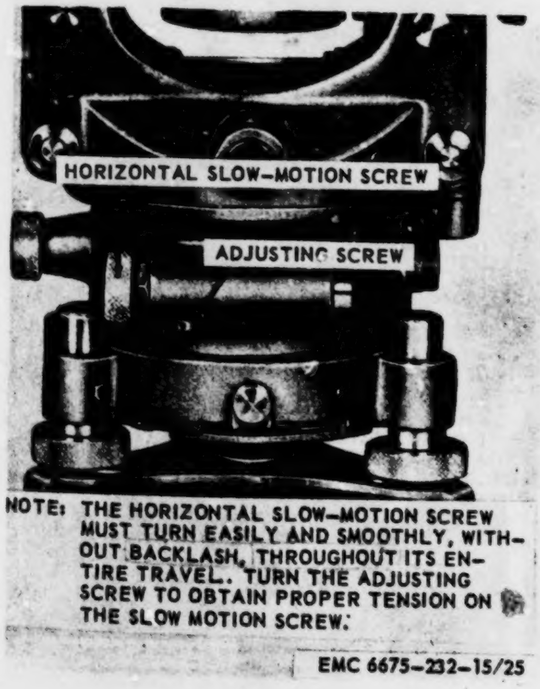
Figure 23. Collimation slow-motion screw adjustmen



NOTE: THE VERTICAL SLOW–MOTION SCREW MUST TURN EASILY AND SMOOTHLY, WITHOUT BLACKLASH, THROUGHOUT ITS ENTIRE TRAVEL. TURN THE ADJUSTING SCREW TO OBTAIN PROPER TENSION ON THE SLOW–MOTION SCREW.

EMC 6675–232–15/24

Figure 24. Vertical slow-motion screw adjustment.



NOTE: THE HORIZONTAL SLOW–MOTION SCREW MUST TURN EASILY AND SMOOTHLY, WITHOUT BACKLASH, THROUGHOUT ITS ENTIRE TRAVEL. TURN THE ADJUSTING SCREW TO OBTAIN PROPER TENSION ON THE SLOW MOTION SCREW.

EMC 6675–232–15/25

Figure 25. Horizontal slow-motion screw adjustment.

g. Horizontal Slow-Motion Screw. Refer to figure 25 and adjust the horizontal slow-motion screw.

h. Compass.

(1) Level the theodolite (par. 18).

(2) Install the compass (par. 9).

(3) Refer to figure 26 and adjust the compass.

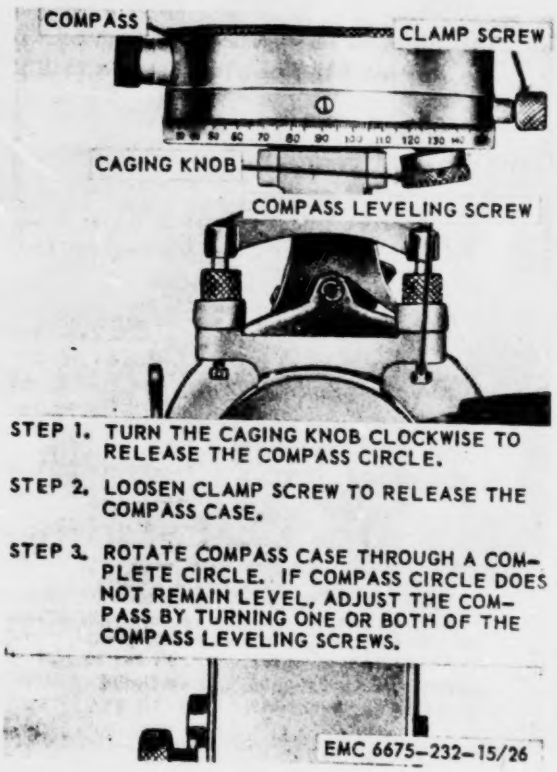
i. Horizontal Collimation.

(1) Set up tripod and theodolite (par. 10).

(2) Sight on well defined object at a distance of approximately 300 feet, with the telescope as nearly horizontal as possible.

(3) Observe and record the horizontal circle reading through the microscope.

(4) Reverse the telescope to the opposite horizontal position and rotate the U-



STEP 1. TURN THE CAGING KNOB CLOCKWISE TO RELEASE THE COMPASS CIRCLE.

STEP 2. LOOSEN CLAMP SCREW TO RELEASE THE COMPASS CASE.

STEP 3. ROTATE COMPASS CASE THROUGH A COMPLETE CIRCLE. IF COMPASS CIRCLE DOES NOT REMAIN LEVEL, ADJUST THE COMPASS BY TURNING ONE OR BOTH OF THE COMPASS LEVELING SCREWS.

EMC 6675–232–15/26

Figure 26. Compass adjustment.

standard 180°. Resight on the same object and observe and record the reading.

(5) Add the 2 readings and subtract 180°; divide the difference by 2. This quotient represents the mean value of the collimation error.

(6) Using the horizontal slow-motion screw, set the mean value of the collimation error on the horizontal circle scale.

(7) Refer to figure 27 and correct the horizontal collimation.

j. Collimation Level.

(1) Inspect and if necessary adjust the theodolite for proper horizontal collimation.

(2) With the telescope in horizontal position and the collimation level at coincidence, the reading of the vertical circle scale must be 90°-0′-0″. To check this, proceed with the following steps:

(*a*) Sight on an object at a distance of at least 300 feet. View the vertical circle scale through the microscope eyepiece and record the reading.

(*b*) Reverse the telescope to the opposite horizontal position and rotate the U-standard until the sighting object is again in view. View the vertical circle scale through the microscope eyepiece and record the reading.

(*c*) The sum of the readings in steps (*a*) and (*b*) must be 360°-0′-0″. If the sum exceeds 360°-0′-0″, one-half of the difference is the collimation error.

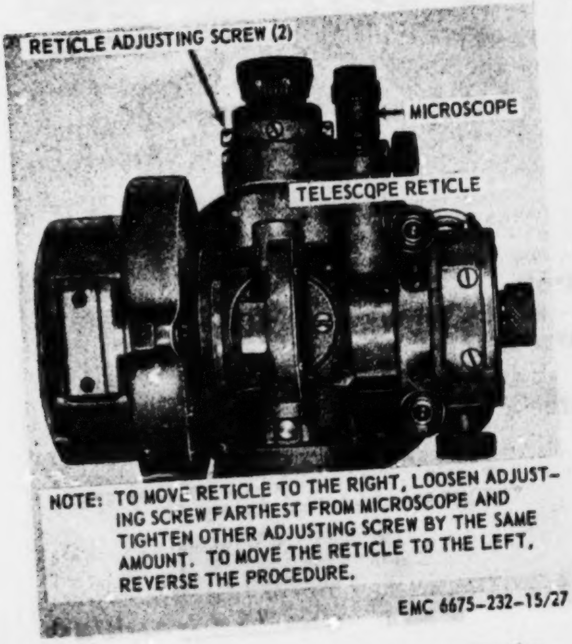
(*d*) To correct this condition resight the object and by means of the collimation level knob, set the corrected value on the vertical circle scale.

(*e*) Remove the collimation level cover (par. 105).

(*f*) Refer to figure 28 and adjust the collimation level.

18. Theodolite Operation

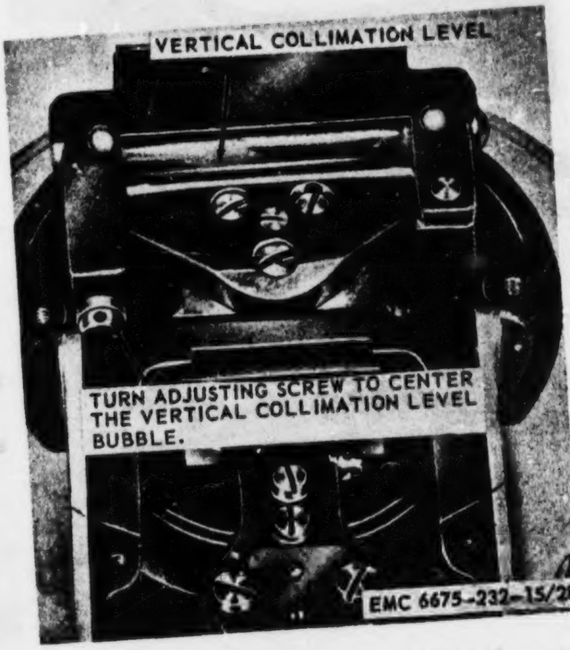
a. Set up the theodolite on the tripod (par. 10).



NOTE: TO MOVE RETICLE TO THE RIGHT, LOOSEN ADJUSTING SCREW FARTHEST FROM MICROSCOPE AND TIGHTEN OTHER ADJUSTING SCREW BY THE SAME AMOUNT. TO MOVE THE RETICLE TO THE LEFT, REVERSE THE PROCEDURE.

EMC 6675-232-15/27

Figure 27. Horizontal collimation error correction.



TURN ADJUSTING SCREW TO CENTER THE VERTICAL COLLIMATION LEVEL BUBBLE.

EMC 6675-232-15/2

Figure 28. Collimation level adjustment.

b. If necessary install the illumination system (par. 11).

Note. To operate the illumination system, position the rheostat knob for desired brilliance and place the hand light switch in the ON position.

c. Install the eyepiece prisms sunglass if required (par. 11).

d. Perform the preventive maintenance services (par. 31).

e. Refer to figure 29 and level the theodolite.

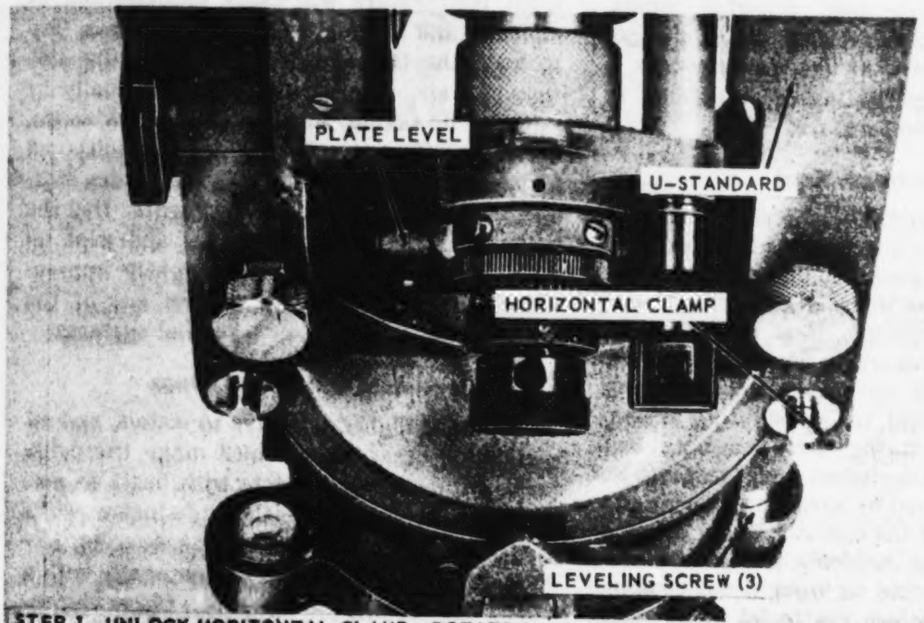
f. Focus the telescope as follows:

(1) Direct the telescope towards a uniformly light background. Turn the diopter ring (fig. 1) on the telescope eyepiece until the crosslines are sharp and black.

Note. Observe the settings on the diopter ring. This setting will remain constant for the same observer but will vary for other observers.

(2) Turn the focusing tube (fig. 1) to bring into view a clear image of the object sighted.

g. The horizontal and vertical circle reading scales are both observed through the microscope eyepiece (fig. 1). The horizontal circle



STEP 1. UNLOCK HORIZONTAL CLAMP. ROTATE U-STANDARD UNTIL PLATE LEVEL IS PARALLEL TO A LINE JOINING ANY TWO LEVELING SCREWS. LOCK HORIZONTAL CLAMP.

STEP 2. TURN THE TWO LEVELING SCREWS THAT ARE PARALLEL WITH PLATE LEVEL, SIMULTANEOUSLY, BUT IN OPPOSITE DIRECTIONS, UNTIL LEVEL BUBBLE IS CENTERED.

STEP 3. UNLOCK HORIZONTAL CLAMP. ROTATE U-STANDARD 90° AND LOCK CLAMP. TURN THIRD LEVELING SCREW UNTIL THE LEVEL BUBBLE IS CENTERED.

STEP 4. UNLOCK HORIZONTAL CLAMP. ROTATE U-STANDARD 180° AND LOCK CLAMP. TURN SAME LEVELING SCREW AS IN STEP 3 AND REMOVE ONE-HALF OF ANY BUBBLE DISPLACEMENT THAT MAY EXIST.

NOTE: IF AFTER STEP 4, THE PLATE LEVEL BUBBLE IS MORE THAN TWO DIVISIONS FROM CENTRALITY, THE CORRECTION IS MADE BY MEANS OF THE PLATE LEVEL ADJUSTING SCREW(PAR. 17).

EMC 6675-232-15/29

Figure 29. Theodolite leveling.

scale image appears in the lower half of the window, and the vertical circle scale image appears in the upper half of the window.

19. Operation in Extreme Cold (Below 0°F.)

With proper precautions and servicing, the theodolite can be used in extreme cold. Its use is limited only by the endurance of operating personnel and by conditions affecting visibility. The instrument should be kept out-of-doors or in unheated buildings for short periods of nonuse. Extreme changes in temperature will cause internal stresses affecting accuracy, and lenses and prisms may become fogged. Theodolites should be cleaned and all possible lubricants removed before being put to use under conditions of extreme cold. Snowfall, winds, and refraction of light are some of the adverse conditions encountered at low temperatures.

Caution: **Avoid subjecting the theodolite to sudden changes in temperature.**

20. Operation in Extreme Heat

Both theodolite and operator should be protected by a surveyor's umbrella when sightings have to be taken in strong sunlight. Direct rays of the sun can cause internal stresses and distortion in the instrument. Heat ripples in the air near ground level create poor sighting conditions. When such conditions prevail, taking shorter sightings will reduce sighting errors. Taking sightings during early morning and late evening will also lessen error magnitude. Operator error caused by eyestrain and fatigue can be kept down if the operator wears suitable dark glasses. If the theodolite is kept in a cool storage place, it should be brought out of storage long enough before use to let instrument temperature approach that of the outside air.

21. Operation in Dusty or Sandy Areas

Special care must be taken of an instrument that is being used in areas where dust and sand occur, since both dust and sand are highly abrasive. Moving parts of the theodolite will soon bind if they are allowed to remain on threaded or sliding surfaces, and the instrument will become inaccurate or inoperable. Brush the theodolite off frequently and carefully wipe it clean. Be extremely careful not to scratch lens and prism surfaces during cleaning operations. Always protect the instrument from dust and sand that is blowing. Put a protective cover over it when not in use.

22. Operation Under Rainy or Humid Conditions

In humid areas, a slight lowering of the ambient temperature will cause condensation of moisture and fogging of lenses and prisms. Try to keep the theodolite warmer than the surrounding air. Internal fogging can usually be removed by taking the theodolite into a warm, dry place. Corrosion due to high humidity can be kept to a minimum by using warm, dry storage areas and by the use of desiccants. Dry the instrument thoroughly after use and wipe all metal parts with a soft cloth lightly impregnated with watch oil. Do not get any of the oil on the lens, prisms, or level vial surfaces.

23. Operation in Salt Water Areas

Salt air is highly corrosive to metals, and especially to brass, from which many theodolite parts are made. Salt reacts with brass to produce a green deposit (verdigris), which must be guarded against and removed as soon as it is noticed. Wipe the instrument frequently with a soft cloth and dry thoroughly. Clean the instrument daily and apply a light film of watch oil to metal parts. If the theodolite is exposed to direct salt spray, it should be cleaned thoroughly and returned to an instrument shop for overhauling as soon as possible.

CHAPTER 3

OPERATOR AND ORGANIZATIONAL MAINTENANCE INSTRUCTIONS

Section I. OPERATOR AND ORGANIZATIONAL MAINTENANCE TOOLS AND EQUIPMENT

24. Special Tools

The special tools required to perform organizational maintenance on the theodolite are listed in table I and in TM 5-6675-232-25P. References and illustrations indicating the use of these tools are listed in the table. The five-digit code preceding the stock number is the Federal supply code number for the manufacturer of the tool.

25. Equipment

No special equipment is required by organizational maintenance personnel for performing maintenance on the theodolite.

26. Basic Issue Tools and Equipment

Tools and repair parts issued with or authorized for the theodolite are listed in the basic issue items list, appendix III of this manual.

27. Organizational Maintenance Repair Parts

Organizational maintenance repair parts are listed and illustrated in TM 5-6675-232-25P.

Table I. Special Tools

Item	FSN or part No.	Fig. No.	Use
Screwdriver, flat tip	5120-446-2860	13	Circular level adjustment.
Pin, adjusting	6675-353-4103	13	Adjust theodolite adjusting screws.
Wrench, tripod	5120-378-9520	11	Tripod leg adjustment, and removal and installation.

Section II. LUBRICATION

28. General Lubrication Information

All moving parts of the theodolite, with both smooth and threaded surfaces, are fitted within extremely fine tolerances. For this reason, most parts of the theodolite must be cleaned before being lubricated. Any attempt to lubricate the theodolite without first cleaning it may result in damage to the instrument, and may render it unfit for use. Unless specifically called for, no lubrication will be performed in the field.

Note. Never perform any lubrication operation other than that specified or use lubricants other than those that are specifically approved for use on the instrument.

29. Detailed Lubrication Information

a. Care of Lubricants. Special care should be taken to see that all surveying instrument lubricants are kept absolutely free from contamination by any foreign substance. Containers must be stored in a clean, dry place and wiped free of dirt or dust before they are opened. All lids or bottle tops must be kept airtight.

b. Approved Lubricants. No lubricants other than those approved for use on surveying instruments will be stocked. Approved lubricants are noncorrosive and highly refined, and must be free from all paint-removing ingredients. Ordinary machine oil is not an approved lubricant. The following lubricants are approved for use on this theodolite:

(1) OCW: oil, clock and watch.

(2) GL: grease, aircraft and instrument.

c. Components Requiring Lubrication.

(1) *Leveling screws.* Turn the leveling screws (fig. 1) outward to the extreme limit of their travel. Clean well with a lint-free cloth. Apply grease sparingly and run the screws through their travel several times to distribute the grease evenly. Wipe off all excess grease.

(2) *Tribrach locking plate.* Unlock the tribrach (fig. 3) from the instrument by pressing the tribrach clamp lever (fig. 4) down and to the right. Remove the tribrach and thoroughly clean all contact points on the tribrach, locking plate, and the lever and its guides. Position the tribrach on the instrument and secure it with the tribrach clamp lever.

(3) *Spring plate.* The sloped sides of the spring plate (fig. 3) which contact the leveling screws to hold them snugly against the tripod base should be greased sparingly as occasion may require.

d. Lubrication Procedure. Cleaning and lubrication services which require partial or complete disassembly of the instrument must be performed in the dust-free atmosphere of an instrument repair shop, and then only by qualified instrument repair personnel. Taking the instrument apart under any other condition, particularly where dust might get into recesses, will do more harm than good. Since the lubricants must be applied sparingly, never use a container with a spout, such as an oil can, to squirt oil on parts or into assemblies.

***Caution:* Never attempt to take the theodolite apart in the field.**

Section III. PREVENTIVE MAINTENANCE SERVICES

30. General

To insure that the equipment is ready for operation at all times it must be inspected systematically, so that defects can be discovered and corrected before they result in serious damage or failure. The necessary preventive maintenance services to be performed are listed and described in paragraphs 31 and 32. The item numbers indicate the sequence of minimum inspection requirements. Defects discovered during operation of the unit will be noted for future correction, to be made as soon as operation has ceased. Stop operation immediately if a deficiency is noticed during operation which would damage the equipment if operation were continued. All deficiencies and shortcomings, together with the corrective action taken, will be recorded on DA Form 2404 (Equipment Inspection and Maintenance Worksheet) at the earliest possible opportunity.

31. Operator's Daily Services

This paragraph contains an illustrated tabulated listing of preventive maintenance services which must be performed by the operator. Daily services retain the same item numbers used in quarterly preventive maintenance services. Therefore, daily preventive maintenance services may not be numbered consecutively but should be performed in the numerical sequence as shown to insure complete coverage. Refer to chart I for daily preventive maintenance services.

32. Quarterly Organizational Maintenance

a. This paragraph contains an illustrated tabulated listing of preventive maintenance services which must be performed by organizational maintenance personnel at quarterly intervals. A quarterly interval is equal to 3 calendar months, or 250 hours of operation, whichever occurs first.

b. The item numbers are listed consecutively and indicate the sequence of minimum requirements. Refer to chart II for the quarterly preventive maintenance services.

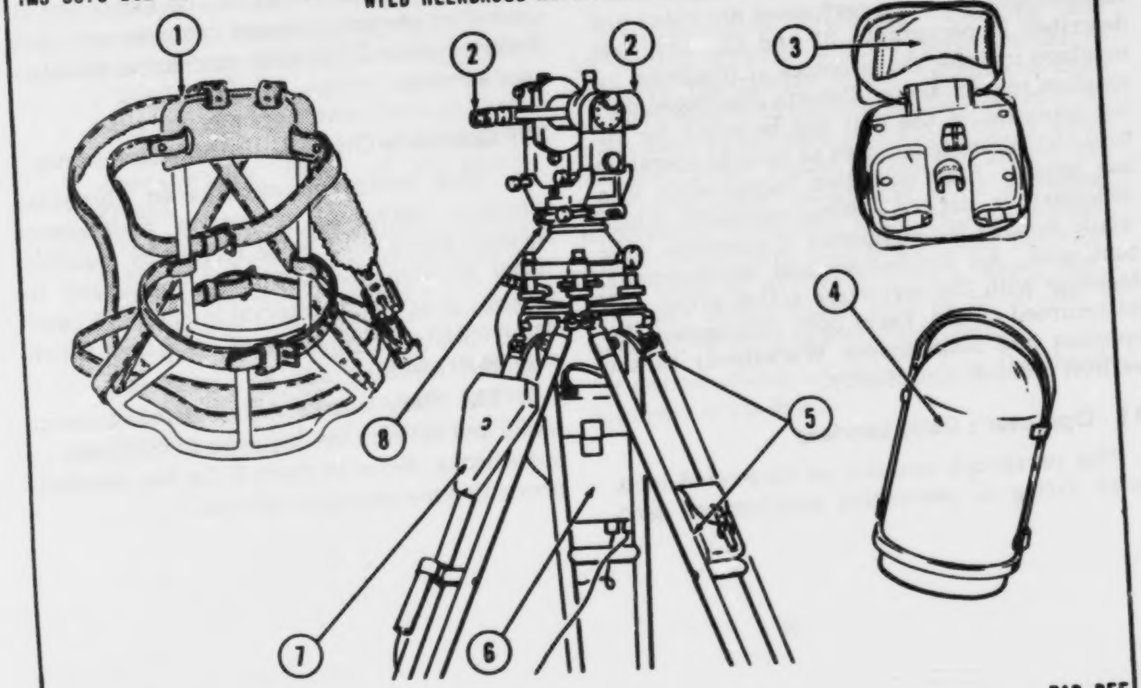
PREVENTIVE MAINTENANCE SERVICES

DAILY

THEODOLITE

TM5-6675-232-15

WILD HEERBRUGG MODEL T-16, TYPE 1



ITEM		PAR REF
1	CANVAS FIELD PACK. Check pack for serviceable condition	56
2	THEODOLITE. Check eyepieces, adjusting and clamping knobs, and adjusting screws for proper operation. Check lenses, level vials, and mirrors for dryness, cleanness, and serviceable condition. Clean lenses, vials, and mirrors.	
3	ACCESSORY CASE. Check case for serviceability and presence of components.	8
4	CARRYING CASE. Check case for serviceability. Check desiccant for proper color (blue). Dehydrate or replace desiccant of any other color. Check base recess for presence of components.	55
5	TRIPOD. Check for serviceable condition. Check pouch for serviceable condition and presence of components.	66

Chart I. Daily preventive maintenance services.

ITEM		PAR REF
6	**BATTERY BOX.** Check box for presence of components. Check batteries and wiring for serviceable condition. Check rheostat for tight and clean connections and for proper operation.	137
7	**HAND LIGHT.** Check light for serviceable condition and proper operation.	138
8	**CONTROLS AND INSTRUMENTS.** Check the controls and instruments for serviceable condition. Check for proper operation	14 15
	NOTE 1. OPERATION. During operation observe for proper function, alignment, adjustment, and calibration.	

MSC 6675-232-15/29.1

Chart I—Continued.

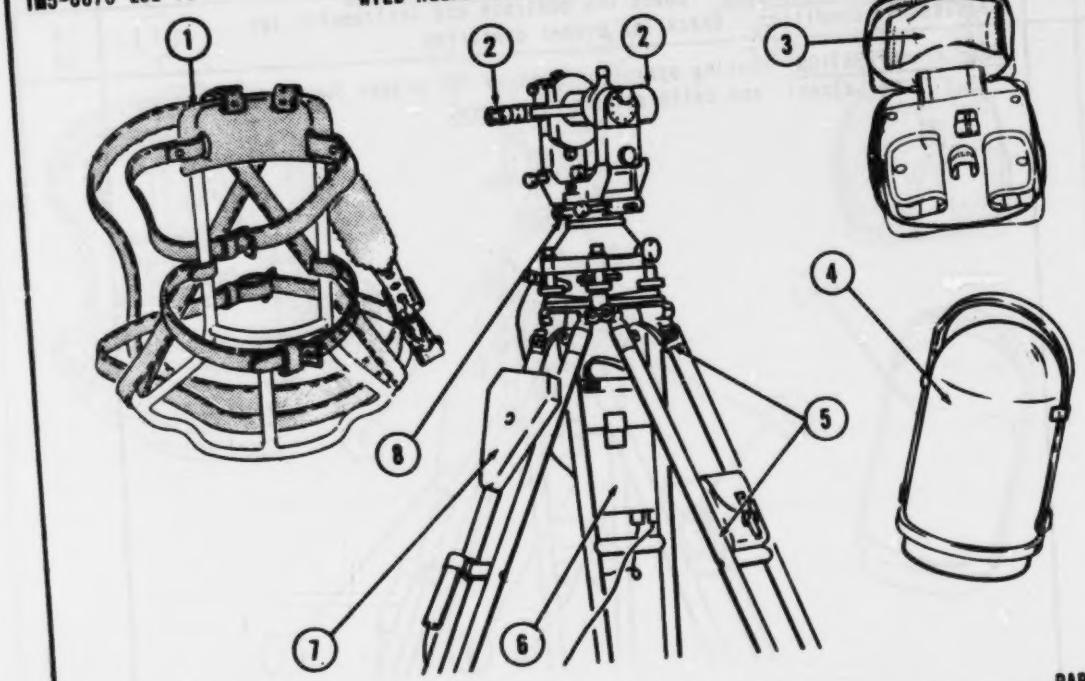
PREVENTIVE MAINTENANCE SERVICES

QUARTERLY

THEODOLITE

TM5-6675-232-15

WILD HEERBRUGG MODEL T-16, TYPE 1



ITEM		PAR REF
1	**CANVAS FIELD PACK.** Inspect pack for serviceable condition.	56
2	**THEODOLITE.** Check compass, eyepieces, adjusting knob, clamping knobs, and adjusting screws for proper operation. Inspect lenses, level vials, and mirrors for dryness cleanness, and serviceable condition. Clean lenses, vials, and mirrors.	8
3	**ACCESSORY CASE.** ·Check case for serviceability and presence of components.	55
4	**CARRYING CASE.** Check case for serviceability. Inspect desiccant for proper color (blue). Dehydrate or replace desiccant of any other color. Inspect base recess for presence of components.	66
5	**TRIPOD.** Check for serviceable condition. Inspect pouch for serviceable condition and presence of components.	

Chart II. Quarterly preventive maintenance services.

ITEM		PAR REF
6	**BATTERY BOX.** Inspect box for presence of components. Check batteries and wiring for serviceable condition. Check rheostat for tight and clean connections and for proper operation.	137
7	**HAND LIGHT.** Check light for serviceable condition and proper operation.	138
8	**CONTROLS AND INSTRUMENTS.** Check the controls and instruments for serviceable condition. Inspect for proper operation.	14 15
	NOTE 1 OPERATIONAL TEST. During operation observe for proper function, alignment, adjustment, and calibration.	
	NOTE 2. ADJUSTMENTS. Make all necessary adjustments during operational test.	

MSC 6675-232-15/29.2

Chart II—Continued.

Section IV. OPERATOR'S MAINTENANCE

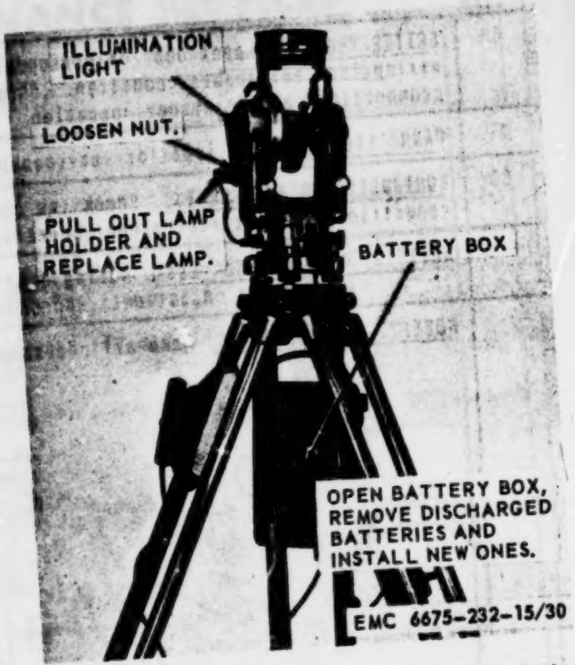

ILLUMINATION LIGHT
LOOSEN NUT.
PULL OUT LAMP HOLDER AND REPLACE LAMP.
BATTERY BOX
OPEN BATTERY BOX, REMOVE DISCHARGED BATTERIES AND INSTALL NEW ONES.
EMC 6675-232-15/30

Figure 30. Lamp and battery, removal and installation

33. Lamp Replacement

Refer to figure 30 and replace a defective lamp.

34. Battery Replacement

Refer to figure 30 and replace an unserviceable battery.

Section V. TROUBLESHOOTING

35. General

This section provides information useful in diagnosing and correcting unsatisfactory operatio or failure of the theodolite and its components. Each trouble symptom stated is followed by a lis of probable causes of the trouble. The possible remedy recommended is described opposite th probable cause. Any trouble that is beyond the scope of organizational maintenance must be r ported to field maintenance, 3d echelon.

36. Compass Circle Will Not Rotate Freely

Probable cause	*Possible remedy*
Caging knob loose	Tighten knob setscrew.
Compass not level	Level compass (par. 17).

37. Compass Housing Will Not Rotate on Compass Base

Probable cause	*Possible remedy*
Clamp screw locked	Release clamp screw (par. 18).

38. Compass Reference Mark Not Clearly Visible

Probable cause	*Possible remedy*
Compass eyepiece not properly focused	Turn focusing knob until sharp image is obtained.
Eyepiece lens dirty	Clean external lens.

39. Compass Assembly Will Not Seat Properly on Theodolite Mounting

Probable cause	*Possible remedy*
Adjusting screws in compass mounting bridge out of adjustment.	Adjust screws (par. 17).

40. Tripod Legs Will Not Lock in Position

Probable cause	*Possible remedy*
Leg clamp nuts and lockscrews too loose	Tighten screws with tripod wrench (par. 18).
Tripod head worn or defective	Replace tripod head (par. 66).

41. Tripod Extension Leg Play Excessive

Probable cause	*Possible remedy*
Wing screws too loose	Tighten wing screws (par. 18).
Tripod leg clamp defective	Replace clamp (par. 66).

42. Theodolite Will Not Seat Properly on Tripod Head

Probable cause	*Possible remedy*
Center screw improperly started or defective	Restart or replace center screw (par. 66).
Star plate defective	Replace tribrach assembly (par. 61).

43. Instrument Will Not Stay on Line

Probable cause	*Possible remedy*
Instrument out of level	Level the instrument (par. 18).
Leveling screws defective	Replace tribrach assembly (par. 61).
Horizontal collimation out of adjustment	Correct collimation (par. 17).
Collimation level out of adjustment	Adjust collimation level (par. 17).

44. Circular Level Bubble Does Not Stay in Center

Probable cause	*Possible remedy*
Circular level out of adjustment	Adjust level (par. 17) or replace tribrach assembly (par. 61).
Tripod clamp loose or defective	Tighten or replace leg clamp (par. 66).

45. Collimation Level Bubble Does Not Stay in Center

Probable cause	*Possible remedy*
Collimation slow-motion screw loose	Adjust screw (par. 17).

46. Plate Level Bubble Does Not Stay in Center

Probable cause	*Possible remedy*
Plate level out of adjustment	Adjust plate level (par. 17).

47. Light on Vertical and Horizontal Circles Unequal or Absent

Probable cause	*Possible remedy*
Illumination mirror not adjusted properly	Adjust mirror.
Illumination lamp defective	Replace lamp (par. 33).
Illumination socket defective	Replace tribrach assembly (par. 61).

48. Illumination System Faulty or Fails to Function

Probable cause	*Possible remedy*
Lamp burned out	Replace lamp (par. 33).
Batteries discharged	Replace batteries (par. 34).

49. Horizontal Circle Hard to Move

Probable cause	*Possible remedy*
Horizontal circle clamp locked	Release clamp (par. 15).

50. Leveling Screws Hard to Move or Have Excessive Play

Probable cause	*Possible remedy*
Leveling screws defective	Replace tribrach assembly (par. 61).

51. Telescope Turns Too Hard or Two Easily

Probable cause	Possible remedy
Vertical clamp screw improperly set	Reset clamp screw (par. 15).

52. Telescope Crosslines Will Not Focus

Probable cause	Possible remedy
Telescope eyepiece defective	Replace eyepiece (par. 58).

53. Circle and Micrometer Images Will Not Focus

Probable cause	Possible remedy
Microscope eyepiece defective	Replace eyepiece (par. 58).

Section VI. CARRYING CASE AND CANVAS FIELD PACK

54. General

The theodolite carrying case (fig. 7) is composed of the hood and base assembly. It provides a safe and convenient means of carrying the theodolite in the field and serves as a dustproof and moistureproof container for the instrument when it is in storage. The canvas field pack has an inner pouch to accommodate the carrying case and two outside pockets to hold the battery case and surveying paraphernalia. Leather straps are provided for lashing the tripod across the top of the pack for cross-country travel. Additional room is found inside the pack for other necessary equipment.

55. Carrying Case

a. Hood.

(1) *Removal.* Remove the hood from the base (par. 7).

(2) *Disassembly.* Refer to figure 31 and disassemble the hood.

(3) *Cleaning, inspection, and repair.*

(*a*) Clean all metal parts with an approved cleaning solvent and dry thoroughly. Clean the carrying strap with saddle soap or other approved leather cleaner.

(*b*) Inspect the carrying strap for cuts, cracks, and breaks. Inspect for worn mounting holes and deterioration due to age and wear.

(*c*) Inspect the lever pins for burs and wear. Inspect the locking levers and clamp springs for burs, bends, and cracks.

(*d*) Inspect the hood for dents, cracks, and holes. Inspect the bottom rim for out-of-round.

(*e*) Remove all burs from lever pins, locking levers, and clamp springs. Straighten all minor bends. Remove any trace of rust; paint where necessary.

(*f*) Straighten all minor dents or bends in the hood. Seal all cuts or holes in the hood by brazing. Smooth out the brazed area and repaint where necessary.

(*g*) Replace all defective parts that cannot be repaired.

(4) *Reassembly.* Refer to figure 31 and reassemble the hood.

(5) *Installation.* Install the hood on the base (par. 7).

b. Base.

(1) *Removal.* Remove the hood and the theodolite from the base (par. 8). Remove the desiccant container.

(2) *Disassembly.* Refer to figure 31 and disassemble the base.

(3) *Cleaning, inspection, and repair.*

(*a*) Clean all metal parts with an approved cleaning solvent and dr thoroughly. Be sure that all threaded surfaces are brushed free of an foreign matter. Wipe the rubbe washer clean with a soft cloth.

(*b*) Inspect all threaded surfaces fo worn or damaged threads. Inspe the levers, lever springs, and washers for burs, bends, dents, and wor surfaces. Inspect the base for crac

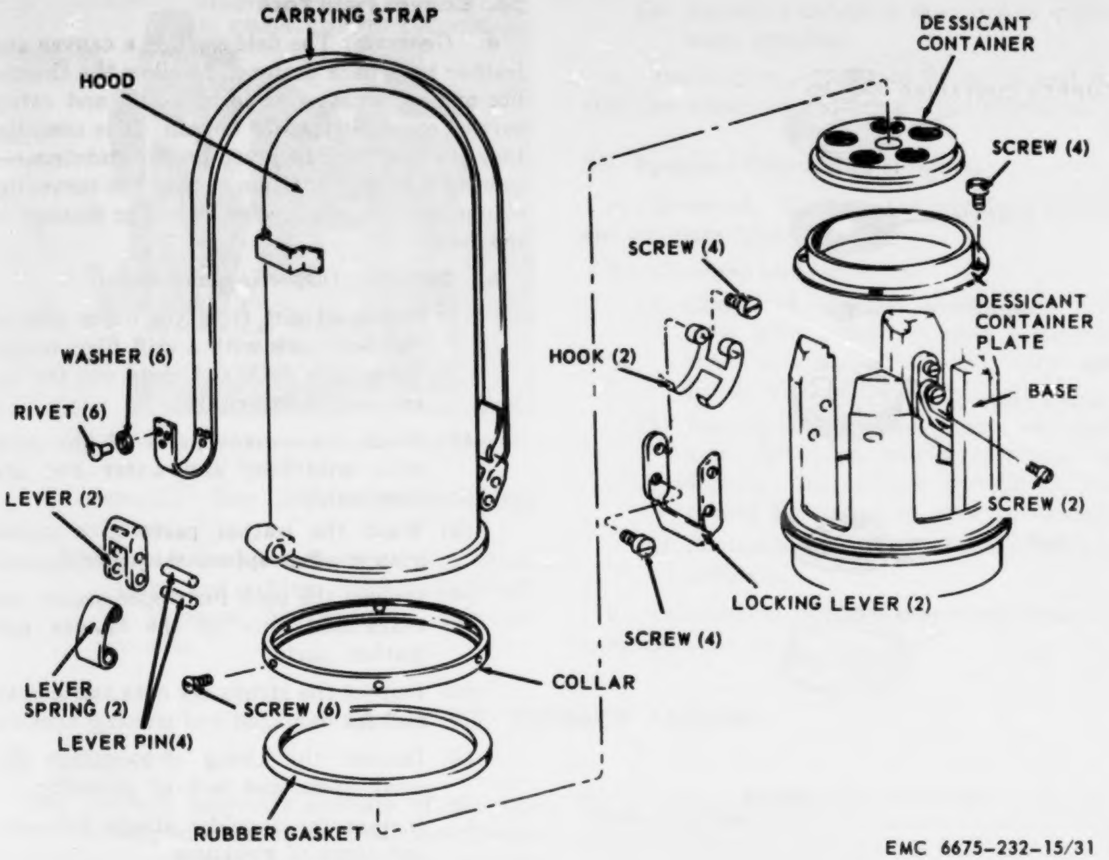

CARRYING STRAP
HOOD
DESSICANT CONTAINER
SCREW (4)
SCREW (4)
DESSICANT CONTAINER PLATE
HOOK (2)
BASE
WASHER (6)
RIVET (6)
LEVER (2)
SCREW (2)
LOCKING LEVER (2)
SCREW (4)
LEVER SPRING (2)
LEVER PIN(4)
SCREW (6)
COLLAR
RUBBER GASKET
EMC 6675-232-15/31

Figure 31. Hood and base, disassembly and reassembly.

and broken casting. Inspect the metal collar for bends, breaks, and out-of-round. Inspect the rubber washer to see whether it is damaged or hardened because of age or excessive heat.

(*c*) Remove all burs from the base, studs, levers, lever springs, and metal collar. Straighten minor bends in the collar and washers. Replace all defective parts.

(4) *Reassembly.* Refer to figure 31 and reassemble the base.

(5) *Installation.* Install the desiccant container, theodolite, and hood on the base (par. 8).

c. Desiccant Container.

(1) *Removal.* Remove the desiccant container from the base (*b* above).

(2) *Disassembly.* Refer to figure 32 and disassemble the desiccant container.

(3) *Cleaning and inspection.*

(*a*) Clean all metal parts with an approved metal cleaning solvent and dry thoroughly. Inspect the window and screen for cracks and breaks. Inspect the three sections of the container for bends, breaks, and damaged threads.

(*b*) Inspect the desiccant for residual capacity. Satisfactory desiccant is blue in color.

(*c*) Replace desiccant that is pink in color or dehydrate it.

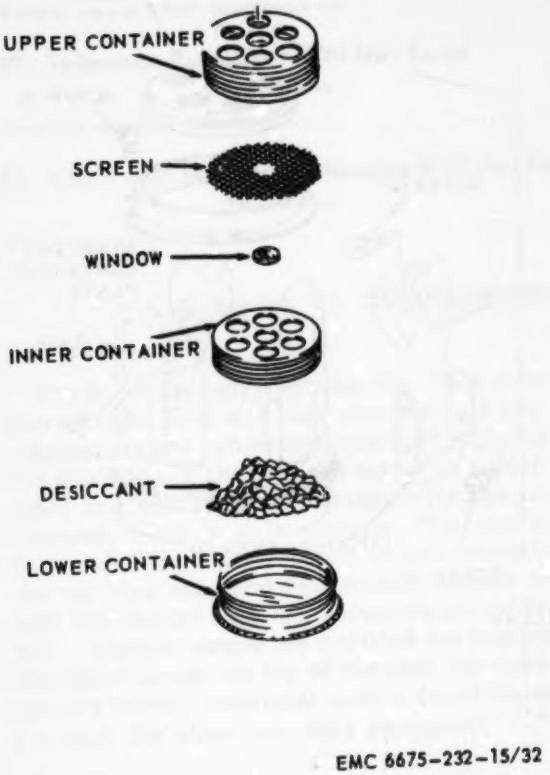


Figure 32. Desiccant container, disassembly and reassembly.

(*d*) Replace all unserviceable parts of the desiccant container.

(4) *Reassembly.* Refer to figure 32 and reassemble the desiccant container.

(5) *Installation.* Install the desiccant container in the base (par. 8).

56. Canvas Field Pack

a. General. The field pack is a canvas and leather back pack designed to allow the theodolite and all accessories to be easily and safely carried over all types of terrain. It is essential that the field pack be given proper maintenance to keep it in top condition so that the surveying equipment is not subjected to loss or damage in the field.

b. Cleaning, Inspection, and Repair.

(1) Brush all dirt from the outer side of the field pack with a stiff fiber brush. Invert the pack and clean out the inside with a soft cloth.

(2) Wash the canvas parts of the pack with mild soap and water and dry thoroughly.

(3) Wash the leather parts with saddle soap or other approved leather cleaner.

(4) Inspect the pack for ripped seams and tears and cuts in the canvas and leather parts.

(5) Inspect the straps for cuts and breaks and for damaged and missing buckles.

(6) Inspect the thong drawstrings for weak spots and lack of pliability.

(7) Inspect the shoulder straps for wear and signs of weakness.

(8) Inspect the metal bow for breaks, bends, and loose rivets.

(9) Restitch a ripped seam. Patch a small tear with canvas or similar material. Tighten a loose rivet. Replace a missing strap or buckle.

(10) Replace an unrepairable field pack.

Section VII. TELESCOPE AND MICROSCOPE EYEPIECES

57. General

The eyepieces used on the Wild T-16 Theodolite consist of the telescope and microscope eyepieces, the eyepiece prisms for both telescope and microscope, and the telescope sunglass. The eyepiece prisms screw directly into the telescope and microscope eyepieces, and the sunglass is a push-fit over the end of both the telescope eyepiece and the telescope eyepiece prism. The eyepiece prisms permit sighting up to 25° from the zenith.

58. Telescope and Microscope Eyepieces

a. Removal. Refer to figure 33 and remove the telescope and microscope eyepieces.

b. Cleaning and Inspection.

(1) Clean the eyepiece lenses with a lint-free cloth moistened with acetone or

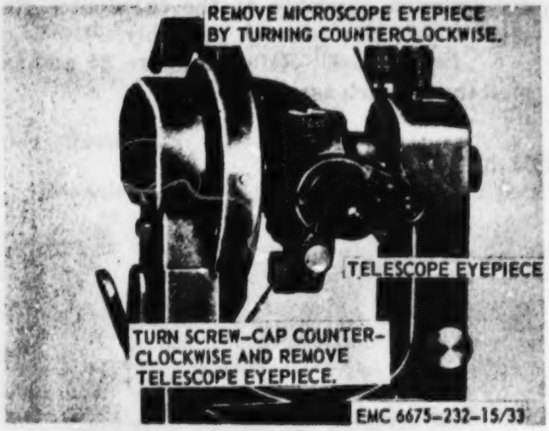

REMOVE MICROSCOPE EYEPIECE BY TURNING COUNTERCLOCKWISE.
TELESCOPE EYEPIECE
TURN SCREW-CAP COUNTERCLOCKWISE AND REMOVE TELESCOPE EYEPIECE.
EMC 6675-232-15/33

Figure 33. Telescope and microscope eyepieces, removal and installation.

alcohol. Dry and polish with lens tissue.

(2) Inspect the lenses for scratches, chips, cracks, and etching. Inspect all threaded surfaces for worn or damaged threads.

(3) Replace a defective telescope or microscope eyepiece.

c. Installation. Refer to figure 33 and install the telescope and microscope eyepieces.

59. Eyepiece Prisms and Sunglass

a. Removal. Remove the eyepiece prisms and sunglass (par. 11).

b. Cleaning and Inspection.

(1) Clean the eyepiece prisms and sunglass with a lint-free cloth moistened with acetone or alcohol. Dry and polish with lens tissue.

(2) Inspect the eyepiece prisms and sunglass for chips, cracks, scratches, or etching. Inspect the threads on the prisms for excessive wear or damage.

(3) Replace a defective eyepiece prism and sunglass.

c. Installation. Install eyepiece prisms and sunglass (par. 11)

Section VIII. TRIBRACH ASSEMBLY

60. General

The tribrach assembly consists of the tribrach, leveling screw, and star plate assemblies. Together they enable the operator to quickly and accurately secure the theodolite to, and remove it from, the preleveled base which remains attached to the tripod head. By using it the operator can shift the instrument back and forth between established stations, as when closing a traverse, without having to level or realine the theodolite each time it is moved.

61. Tribrach Assembly

a. Removal. Refer to figure 34 and remove the tribrach assembly.

b. Cleaning and Inspection. Brush all dirt, dust, and foreign matter from the tribrach components. Wipe all surfaces clean with a soft, lint-free cloth moistened with an approved cleaning solvent. Thoroughly clean all bearing surfaces that the tapered locking wedges ride on. Inspect the tribrach, star plate, and spring plate for cracks and breaks. Inspect the leveling screws for improper operation. They should

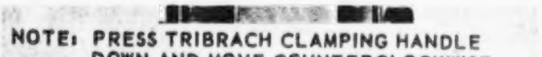

NOTE: PRESS TRIBRACH CLAMPING HANDLE DOWN AND MOVE COUNTERCLOCKWISE TO REMOVE TRIBRACH FROM THEODOLITE BASE.
TRIBRACH CLAMPING HANDLE
THEODOLITE BASE
TRIBRACH
LEVELING SCREW (3)
STAR PLATE
EMC 6675-232-15/34

Figure 34. Tribrach assembly, removal and installation.

turn smoothly and evenly, yet require a moderate amount of force exerted by thumb and forefinger to turn without backlash. Lubricate bearing surfaces sparingly before reassembling the tribrach assembly to the theodolite. Replace a defective tribrach assembly.

c. Installation. Refer to figure 34 and install the tribrach assembly.

Section IX. ILLUMINATION MIRROR ASSEMBLY

62. General

The rotatable illumination mirror assembly is used to reflect available natural light through the illuminating prisms within the theodolite and onto the reading circles. At night and on dark days it is replaceable by the electrical illumination lamp.

63. Illumination Mirror Assembly

a. Removal. Refer to figure 35 and remove the illumination mirror assembly.

b. Cleaning and Inspection. Clean the metal parts with a soft cloth moistened with an approved cleaning solvent. Clean the mirror with a camel's-hair brush, if dusty, and with the chamois, if foggy. Inspect the hinge action for too stiff or too loose movement. It should remain in the position where placed. Inspect the push-fit mirror mounting for too tight or too loose fit, distortion, and other damage. Oil the hinge sparingly if needed, and wipe off all excess oil. Inspect for a lost, cracked, or broken mirror. Replace a defective illumination mirror assembly.

c. Installation. Refer to figure 35 and install the illumination mirror assembly.

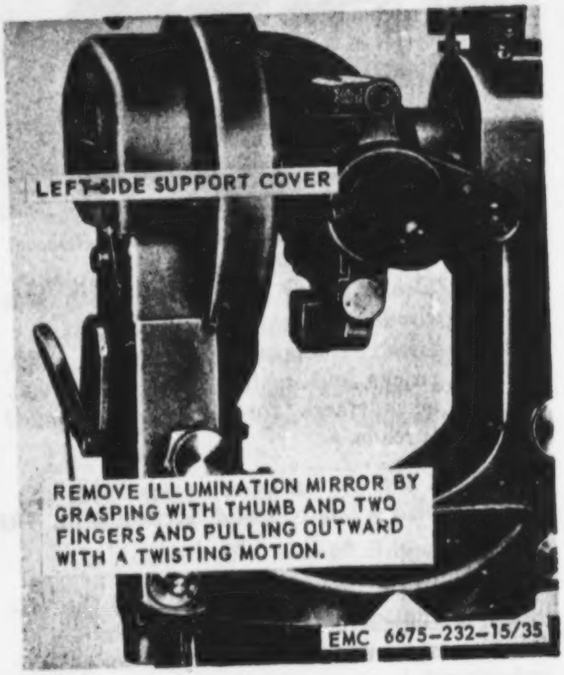

LEFT-SIDE SUPPORT COVER
REMOVE ILLUMINATION MIRROR BY GRASPING WITH THUMB AND TWO FINGERS AND PULLING OUTWARD WITH A TWISTING MOTION.
EMC 6675-232-15/35

Figure 35. Illumination mirror assembly, removal and installation.

Section X. TELESCOPE LEVEL ASSEMBLY

64. General

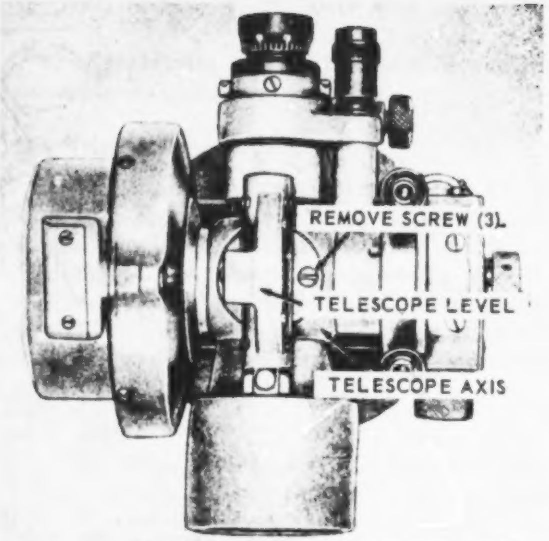
The telescope level provides a means for positioning the telescope in a true horizontal position. The telescope level reading prism can be rotated so that the level bubble can be seen when the telescope is reversed 180°.

65. Telescope Level Assembly

a. Removal. Refer to figure 36 and remove the telescope level assembly.

b. Cleaning and Inspection. Clean the metal parts with a cloth moistened with an approved cleaning solvent. Clean the prism and vial window with a soft, clean cloth moistened with grain alcohol or acetone. Inspect the vial and prism for cracks, chips, and etching. Replace a defective telescope level assembly.

c. Installation. Refer to figure 36 and install the telescope level assembly.



EMC 6675-232-15/36

Figure 36. Telescope level assembly, removal and installation.

Section XI. TRIPOD ASSEMBLY, PLUMB BOB ASSEMBLY, AND TRIPOD WRENCH

66. Tripod Assembly

a. Disassembly. Refer to figure 37 and disassemble the tripod assembly.

Caution: **The three clamp nut lock screws have left-hand threads.**

b. Cleaning, Inspection, and Repair.

(1) Clean all metal parts with an approved cleaning solvent. Clean the wooden parts with a soft cloth moistened with water and dry thoroughly. Clean the belt with a suitable leather cleaner.

(2) Inspect the tripod leg housings and cover for burs, cracks, and wear. Inspect the head and bridge for bends, burs, cracks, breaks, scratches, wear, and damage. Inspect the clamps, shoes, cover fixing plate, and battery box bracket for cracks, bends, and wear. Inspect the accessory case and belt for cuts, wear, and ripped seams. Inspect the wooden legs for cracks, splits, splinters, wear and warping.

(3) Remove all burs. Straighten minor dents and bends. Sew damaged seams on the accessory case. Sandpaper and varnish the wooden legs if the protective coating is worn or damaged.

(4) Replace all defective parts that cannot be repaired.

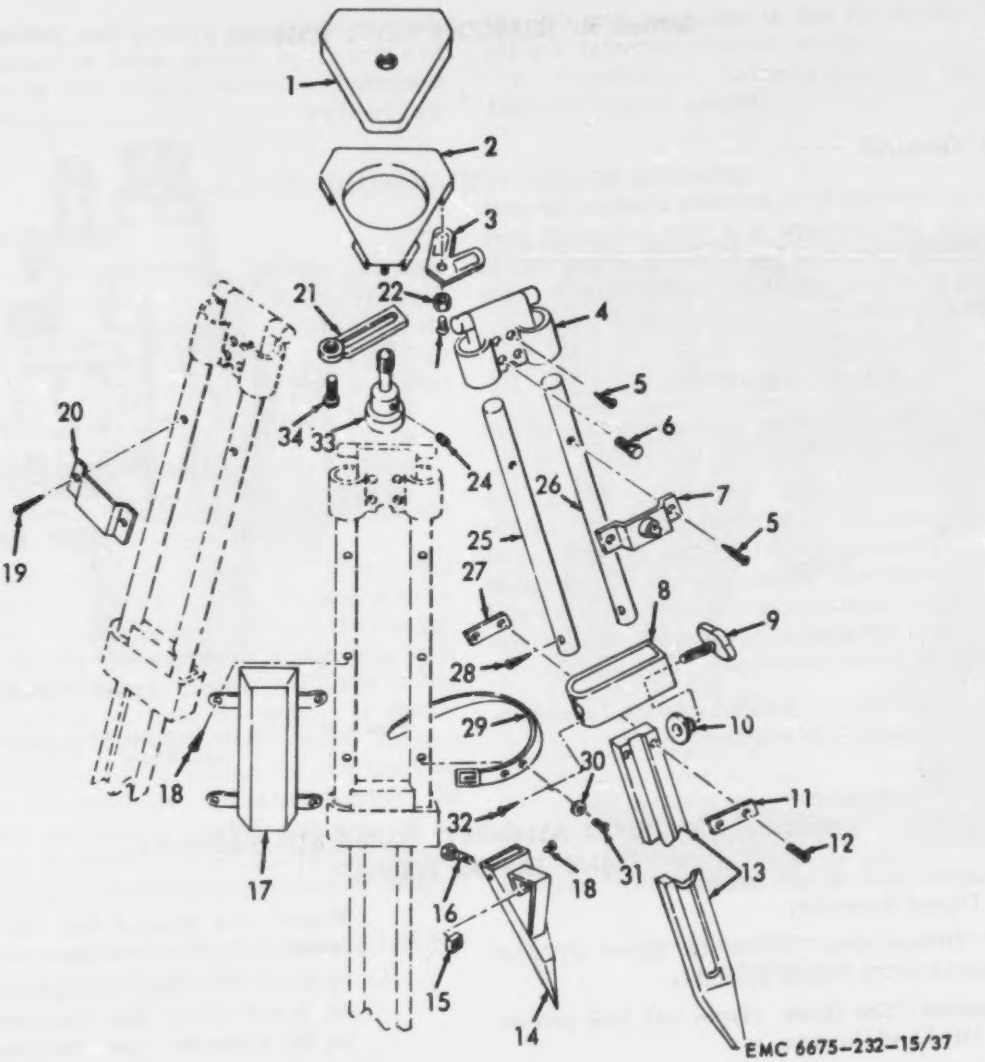
c. Reassembly. Refer to figure 37 and reassemble the tripod.

67. Plumb Bob Assembly

a. Disassembly. Refer to figure 38 and disassemble the plumb bob assembly.

b. Cleaning, Inspection, and Repair.

(1) Clean all metal parts with an approved cleaning solvent and dry thoroughly. Wash the cords with soap and water, rinse, and dry thoroughly.


1
2
3
21
22
4
5
6
20
34
33
24
26
7
5
25
19
27
8
9
28
29
10
30
11
12
18
32
31
18
13
17
16
15
14
EMC 6675-232-15/37

1 Cover
2 Head
3 Clamp (3 rqr)
4 Housing (3 rqr)
5 Screw (8 rqr)
6 Machine bolt (6 rqr)
7 Cover bracket
8 Clamp (3 rqr)
9 Clamp nut lock screw (3 rqr)
10 Clamp plate (3 rqr)
11 Outer stop plate (3 rqr)
12 Machine screw (6 rqr)
13 Lower leg (3 rqr)
14 Tripod leg shoe (3 rqr)
15 Square nut (3 rqr)
16 Capscrew (spec) (3 rqr)
17 Tool kit assembly
18 Wood screw (10 rqr)
19 Wood screw (2 rqr)
20 Battery box bracket
21 Centering bracket
22 Nut (3 rqr)
23 Screw (3 rqr)
24 Screw
25 Left upper leg (3 rqr)
26 Right upper leg (3 rqr)
27 Inner stop plate (3 rqr)
28 Machine screw (6 rqr)
29 Leather strap
30 Washer (2 rqr)
31 Wood screw (2 rqr)
32 Wood screw (12 rqr)
33 Center screw
34 Machine screw

Figure 37. Tripod assembly, disassembly and reassembly.

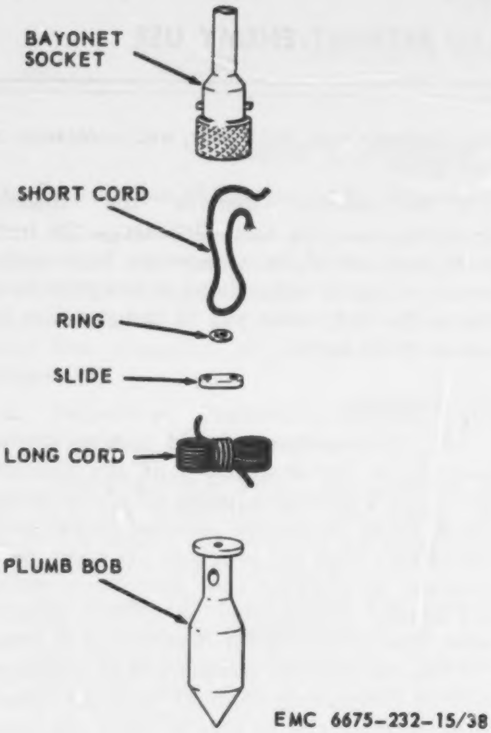


Figure 38. Plumb bob assembly, disassembly and reassembly.

(2) Inspect the plumb bob, bayonet socket, ring, and slide for cracks, breaks, and wear. Inspect the lugs on the bayonet socket for burs and bends. Inspect the cords for knots and fraying.

(3) Replace all defective parts that cannot be repaired.

c. Reassembly. Refer to figure 38 and reassemble the plumb bob assembly.

68. Tripod Wrench

a. General. The tripod wrench (fig. 11) is kept in a pocket of the tripod accessory case. It has wing lugs for turning it with thumb and forefinger. The hexagonal socket fits the 12-mm metric nuts and screw heads used on the tripod. The wrench is used to tighten or loosen the nuts and capscrews that hold major components of the tripod together.

b. Cleaning and Inspection.

(1) Clean all dust, dirt, and foreign matter from the wrench with an approved cleaning solvent. Dry thoroughly.

(2) Inspect the wing lugs for burs, bends, breaks, and other damage. Inspect the hex socket for burs and distortion. Inspect the protective coating for scratches, chipping, and wear.

(3) Remove all burs. Straighten a slightly bent wing lug. Repaint the wrench as needed.

(4) Replace an unserviceable tripod wrench.

CHAPTER 4

DEMOLITION OF THEODOLITE TO PREVENT ENEMY USE

69. General

When capture or abandonment of the theodolite to an enemy is imminent, the responsible unit commander must make the decision either to destroy the equipment or to render it inoperative. Based on this decision, orders are issued which cover the desired extent of destruction. Whatever method of demolition is employed, it is essential to destroy the same vital parts of all theodolites and all corresponding repair parts.

70. Demolition to Render the Theodolite Inoperative

a. Mechanical Means. Using a hammer, bar, or other suitable tool, break all lenses, level vials, telescope, microscope, alidade and standards, tribrach, tripod base, ground plate, and metal hood. Destroy the tripod, battery box, and accessory case. Rip the field pack apart.

b. Burning. Pack fuel-soaked rags, canvas, or other flammable material around the uncased theodolite, ground plate, metal hood, tripod, battery box, field pack, and accessory case and ignite.

c. Submersion. Remove the theodolite from the carrying case. Submerge the instrument and all of its accessories in a body of water to insure water damage and provide concealment. Salt water will do the greatest damage to metal parts.

71. Training

All instrumentmen should receive thorough training in the destruction of the theodolite. Simulated destruction, using all of the methods listed above, should be included in the instrumentman's training program. It must be emphasized in training that demolition methods are usually necessitated by critical situations when time available for destruction is limited. For this reason, it is necessary that instrumentmen be thoroughly familiar with all methods of destruction and be able to carry out demolition instructions without reference to this or any other manual.

CHAPTER 5

SHIPMENT AND LIMITED STORAGE

Section I. SHIPMENT WITHIN ZONE OF INTERIOR

72. Preparation of Equipment for Shipment

a. General. Detailed instructions for the preparation for domestic shipment are outlined within this paragraph. Preservation will be accomplished in sequence that will not require the operation of previously preserved components.

b. Inspection. Perform a complete inspection as outlined in paragraph 8.

c. Cleaning and Drying. Remove dust and dirt from the theodolite, dry thoroughly. Refer to TM 38–230 for selection and application of cleaning and drying methods.

> *Exception:* Clean all lenses and external prism, using the camel's-hair brush issued with the equipment. Remove the batteries, clean the contact points, and pack batteries in a fiberboard container with other accessories.

d. Painting. Paint all surfaces where the paint has been removed or damaged. Refer to TB ENG 60 for detailed cleaning and painting instructions.

e. Lubrication. Refer to paragraphs 28 and 29 for selection and application of a lubricant and areas to be lubricated.

f. Exterior Surfaces. When the instrument is to be placed in its carrying case and shipping case, it is not necessary to coat the machined ferrous metal surfaces with preservative. If the cases have become damaged or are not available, immediately after cleaning, exposed threads and unpainted machined ferrous metal surfaces of parts and accessories will be coated with only lubricants specifically approved for use on the instrument will be used.

g. Marking. Marking will conform to MIL–STD–129. Fragile labels (DA Labels 3, 4, or 5) will be affixed to at least 3 surfaces of the theodolite shipping case.

h. Disassembly and Packing.

(1) Fill the desiccant container with fresh desiccant.

(2) Disassemble and pack the accessories (reverse the instructions in par. 7) in the shipping cases. Pack the cases in an economical but adequate shipping container. Refer to TM 38–230 for selection and fabrication of a suitable container.

73. Loading Equipment for Shipment

a. Loading. The theodolite in its shipping case weighs 30 pounds. The crated tripod and accessories weigh 62 pounds. One man can easily carry the equipment onto the carrier.

b. Shipping. Air transport is the best way to ship the theodolite. There is less stress on the instrument from vibration, jolts, and sudden starts and stops. Tie the shipping cases down securely, taking precautions that the theodolite shipping case will not be struck by loose objects or shifting freight.

Section II. LIMITED STORAGE

74. Preparation of Equipment for Storage

a. General. Detailed instructions for preparation and maintaining the theodolite in limited storage are outlined in paragraph 72*b* through *h*. Limited storage is defined as storage not to exceed 6 months. Refer to AR 743–505.

b. Storage. Store the theodolite, tripod, and accessories in a dry dust-free location where there is a minimum of vibration.

75. Inspection and Maintenance of Equipment in Storage

Frequent inspection must be made to assure that the equipment is ready for immediate use. Frequency of inspections will be prescribed by the unit commander, taking into consideration such factors as the physical condition of the storage area, weatherproofing, vibrations, security from tampering or pilferage, humidity, and temperature conditions. The tripod and accessories should be inspected frequently unless they are in hermetically sealed packages containing adequate amounts of desiccant.

CHAPTER 6

FIELD AND DEPOT MAINTENANCE INSTRUCTIONS

Section I. GENERAL

76. Scope

a. The following instructions are for field and depot maintenance personnel. They contain information on equipment maintenance that is beyond the scope of the tools, equipment, personnel, or supplies normally available to organizational maintenance.

b. Appendix I includes the publications applicable to field and depot maintenance. Appendix II contains the maintenance allocation chart. The field and depot maintenance repair parts and special tool lists are listed in TM 5-6675-232-25P.

77. Record and Report Forms

For record and report forms applicable to field and depot maintenance, refer to TM 38-750.

Note. Applicable forms, excluding Standard Form 46, which is carried by the operator, will be kept in a canvas bag mounted on the equipment.

Section II. DESCRIPTION AND DATA

78. Description

For a complete description of the theodolite, see paragraph 3.

79. Tabulated Data

a. General. Tabulated data are listed in paragraph 4. Engineering data, such as tolerances, wear limits, and the like, are not available, inasmuch as all parts of each theodolite are hand-fitted to each other.

b. Time Standards. Table II lists the number of man-hours required under normal conditions to perform the indicated maintenance and repair for the theodolite. Components are listed under the appropriate functional index. The times listed are not intended to be rigid standards. Under adverse conditions, the operations will take longer; but under ideal conditions with highly skilled mechanics, most of the operations can be accomplished in considerably less time.

Table II. Time Standards

	Hours
(1) *Lubrication and Service.*	
67 PRECISION INSTRUMENTS AND SYSTEMS, MECHANICAL, ELECTRICAL, OR ELECTRONIC.	
6700 THEODOLITE	
Theodolite:	
Clean (general)	0.3
(Use soft cloth, free from dirt and oil, only on exterior parts, not to include lens and mirrors. Do not use water, oil, or liquids when cleaning.)	
Clean (special)	0.4
(Use cheese cloth to clean mirrors and lens. Use saddle soap on tripod accessory case when leather becomes hard or dry. Use linseed oil on tripod legs and all wood material. Use very stiff brush when cleaning canvas cases and field pack.)	

Table II. Time Standards—Continued

(2) Remove and Replace.

	Hours
17 BODY; CAB; HOOD; HULL.	
1708 CARRYING CASES.	
Hood, carrying case	0.1
Base, carrying case	0.1
Field pack, canvas	0.1
Case, shipping theodolite	0.1
26 ACCESSORIES, PUBLICATIONS TEST EQUIPMENT AND TOOLS.	
2602 ACCESSORIES.	
Case, accessory	0.1
Plumb bob	0.1
Cover, instrument	0.1
2604 SPECIAL TOOLS.	
Wrench, tripod	0.1
67 PRECISION INSTRUMENTS, MECHANICAL OR ELECTRICAL.	
6700 THEODOLITE.	
Theodolite (Includes adjustment.)	0.6
6701 TELESCOPE ASSEMBLY.	
Axis, telescope (Includes removal and installation of microscope, telescope eyepiece, and reticle bearing, reticle mirror, and telescope level.)	6.0
Tube, telescope (Includes removal and installation of objective assembly.)	1.0
Washer, sight (Includes removal and installation of objective assembly.)	0.6
Bearing, telescope axis (Includes removal and installation of vertical circle and vertical clamp.)	3.0
6702 OPTICS (REFLECTING AND TRANSMITTING TYPES).	
Objective assembly, telescope	1.0
Focusing assembly, telescope (Includes removal and installation of microscope assembly and eyepiece and reticle assembly.)	1.4
Lens assembly, focusing (Includes removal and installation of microscope, telescope eyepiece, and reticle assembly.)	1.6
Reticle assembly, telescope (Includes removal and installation of eyepiece assembly.)	0.3
Eyepiece assembly, telescope	0.2
Microscope assembly	0.6
Lens assembly, microscope	0.8
Eyepiece assembly, microscope	0.2
Mirror assembly illumination	0.1
Mirror, telescope	0.4
Optical plumb device (Includes removal and installation of tribrach assembly and outer housing.)	4.0
Eyepiece assembly, optical plumb	0.2
Eyepiece assembly, compass	0.2
Mirror, level	0.4
Mirror, collimation level	0.4
Sunshade, telescope	0.1
Circle, horizontal (Includes removal and installation of horizontal circle housing.)	4.5
Circle assembly, vertical (Includes removal and installation of vertical collimation housing and lever assemblies.)	2.5

Table II. Time Standards—Continued

		Hours
6702	OPTICS (REFLECTING AND TRANSMITTING TYPES)—Continued	
	Prisms, internal	4.0
	(Includes removal and installation of horizontal circle base housing.)	
6703	MECHANICAL, STRUCTURAL, AND PRECISION PARTS.	
	Vertical clamp assembly	3.0
	Tribrach assembly	0.2
	Plate assembly, star-shaped	0.2
	U-Standard assembly	6.0
	(Includes removal and installation of vertical inner axis, telescope axis assembly, plate level, lens assemblies clamp pins, and compass holder.)	
	Screw, leveling	0.3
	(Includes removal and installation of star plate.)	
	Housing assembly, horizontal circle	4.0
	(Includes removal and installation of tribrach, horizontal circle clamp and prism, vertical inner axis, optical plumb, and U-standard.)	
	Clamp, horizontal	4.5
	(Includes removal and installation of horizontal circle housing assembly.)	
	Housing assembly, inner base	4.5
	(Includes removal and installation of horizontal circle housing.)	
	Screw assemblies, slow-motion	0.6
	Clamp assembly, circle	0.3
6708	BATTERIES.	
	Battery, dry	0.2
6709	LAMPS.	
	Illumination assembly, electrical	0.1
	Light, hand	0.1
	Lamp (bulb)	0.1
6718	MOUNTED CONNECTING DEVICES.	
	Plug, illumination light	0.8
	Contact ring segments	4.0
	(Includes removal and installation of horizontal circle housing.)	
6719	MISCELLANEOUS WIRING AND FITTINGS.	
	Cable, electrical (internal)	3.0
6723	POWER SUPPLY (SELF-CONTAINED UNIT).	
	Battery box assembly	0.1
	Cable, electrical	0.1
6724	COMPASS AND LEVELS.	
	Compass assembly, directional	0.2
	Bridge assembly, compass	0.2
	Glass, cover	1.2
	Needle, compass	1.4
	Legs, compass	0.4
	Lock, compass	0.6
	Level assembly, circular	0.6
	Level, plate	0.8
	Level assembly, collimation	1.0
	Level, telescope	0.3
6725	TRIPODS.	
	Tripod assembly	0.1
	Head assembly, tripod	0.5
	Tripod leg assembly	0.5
	Clamp assembly, leg	0.4
82	MINERALS AND CHEMICALS.	
	Container, desiccant	0.2

Section III. SPECIAL TOOLS AND EQUIPMENT

80. Special Tools and Equipment

No special tools or equipment are required for field and depot maintenance of the theodolite.

81. Field and Depot Maintenance Repair Parts

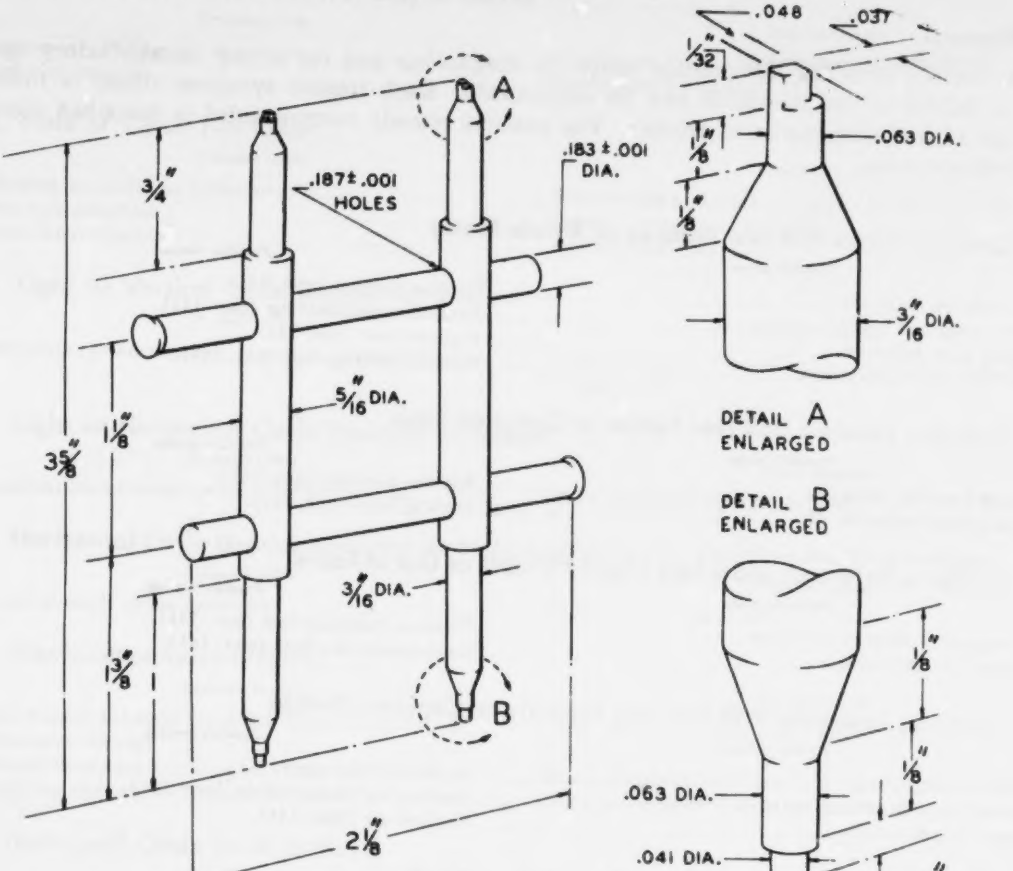
Field and depot maintenance repair parts are listed and illustrated in TM 5-6675-232-25P.

82. Specially Designed Tools

The specially designed tools illustrated in figure 39 and listed in table III are for field and depot maintenance personnel performing major overhaul work on the theodolite. The specially designed tools listed in table III are not available for issue, but must be fabricated by qualified field and depot maintenance personnel.

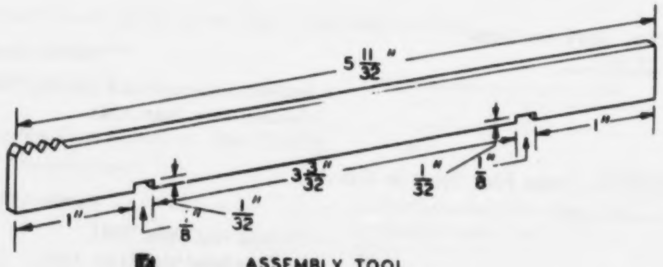
Table III. Specially Designed Tools

Item	Reference		Use
	Figure	Paragraph	
Adjustable spanner wrench.	39	134	Remove mirror axis nut.
		111	Remove horizontal circle housing.
		118	Remove clamp pins.
		124	Remove 90° prism sleeve.
Assembly tool.	39	141	Remove compass window lockring.


.048
.037
1/32"
.063 DIA.
1/8"
1/8"
3/16" DIA.
A
DETAIL A ENLARGED
DETAIL B ENLARGED
.183 ± .001 DIA.
.187 ± .001 HOLES
3/4"
5/16" DIA.
3 5/8"
1 1/8"
3/16" DIA.
1 3/8"
B
2 1/8"
1/8"
1/8"
.063 DIA.
.041 DIA.
3/64"

A ADJUSTABLE SPANNER WRENCH

MATERIAL: STEEL DRILL ROD


5 11/32"
1"
3 3/32"
1/32"
1/8"
1"
1/8"
1/32"

B ASSEMBLY TOOL

MAKE FROM HACKSAW BLADE

EMC 6675-232-15/39

Figure 39. Specially designed tools.

Section IV. TROUBLESHOOTING

83. General

This section provides information useful in diagnosing and correcting unsatisfactory operation or failure of the theodolite and its components. Each trouble symptom stated is followed by a list of probable causes of trouble. The possible remedy recommended is described opposite the probable cause.

84. Compass Circle Will Not Balance or Rotate Freely

Probable cause	Possible remedy
Circle weights defective	Replace weights (par. 141).
Worn or damaged needle bearing	Replace needle bearing (par. 141).
Compass base defective	Replace base (par. 141).
Circle lifter spring damaged	Replace lifter spring (par. 141).

85. Compass Housing Will Not Rotate on Compass Base

Probable cause	Possible remedy
Compass housing defective	Replace housing (par. 141).
Compass base defective	Replace base (par. 141).

86. Compass Reference Mark Not Clearly Visible or Out of Focus

Probable cause	Possible remedy
Reading prism dirty or defective	Clean or replace prism (par. 141).
Eyepiece lens defective	Replace eyepiece lens (par. 141).

87. Compass Assembly Will Not Seat Properly on Compass Bridge

Probable cause	Possible remedy
Compass bridge bent	Replace bridge (par. 141).
Compass leg pins or knob worn or damaged	Replace leg pins or knobs (par. 141).
Compass leg defective	Replace leg (par. 141).

88. Theodolite Will Not Seat Properly on Tripod Head

Probable cause	Possible remedy
Star plate defective	Replace star plate (par. 103).
Star plate nut defective	Replace nut (par. 103).

89. Telescope Will Not Stay on Line

Probable cause	Possible remedy
Vertical travel off line	Replace telescope axis bearing (par. 134).
Telescope axis defective	Replace axis (par. 134).

90. Circular Level Bubble Does Not Stay in Center

Probable cause	Possible remedy
Vial loose in mount	Cement vial (par. 103).
Level vial defective	Replace level vial (par. 103).

91. Collimation Level Bubble Does Not Stay in Center

Probable cause	Possible remedy
Vial holding screws loose	Tighten screws (par. 122).
Collimation level loose	Adjust and tighten screws (par. 122).
Level vial defective	Replace level vial (par. 122).
Spring sticking	Clean spring (par. 122).

92. Plate Level Bubble Does Not Stay in Center

Probable cause	*Possible remedy*
Leveling screws loose or worn	Tighten or replace screws (par. 117).
Level vial defective	Replace level vial (par. 117).

93. Field of Vision Not Clear

Probable cause	*Possible remedy*
Objective lens dirty or defective	Disassemble and clean or replace lenses (par. 132).
Focus lens defective	Replace focus lens (par. 132).
Reticle lens defective	Replace lens (par. 131).

94. Light on Vertical Circle Unequal or Absent

Probable cause	*Possible remedy*
Combination prism and lens assembly dirty or defective	Clean or replace in combination prism and lens assembly (par. 129).

95. Light on Horizontal Circle Unequal or Absent

Probable cause	*Possible remedy*
Horizontal illumination prism dirty or defective	Clean or replace prism (par. 129).

96. Horizontal Circle Graduations Not At Right Angles to Line Dividing the Two Images

Probable cause	*Possible remedy*
Horizontal circle prism defective	Replace prism (par. 109).

97. Illumination System Faulty

Probable cause	*Possible remedy*
Faulty contact between horizontal circle housing and inner base housing.	Clean spring contact and inspect housing plug (par. 111).
Cable and connector contact pins faulty	Repair or replace cable and pins (par. 139).
Battery box rheostat or contacts defective	Repair or replace battery box (par. 137).

98. Horizontal Circle Hard to Move

Probable cause	*Possible remedy*
Outer vertical axis worn or damaged	Replace axis (par. 113).
Ball bearing dirty, dry, or defective	Clean, lubricate, or replace ball bearing (par. 114).
Horizontal slow-motion screw defective	Repair or replace screw mechanism (par. 110).

99. Leveling Screws Hard to Turn or Have Excessive Play

Probable cause	*Possible remedy*
Leveling screws damaged or worn	Replace screws (par. 103).

100. Telescope Turns Too Hard or Too Easily

Probable cause	*Possible remedy*
Axis bearings defective	Replace bearings (par. 134).
Axis defective	Replace axis (par. 134).

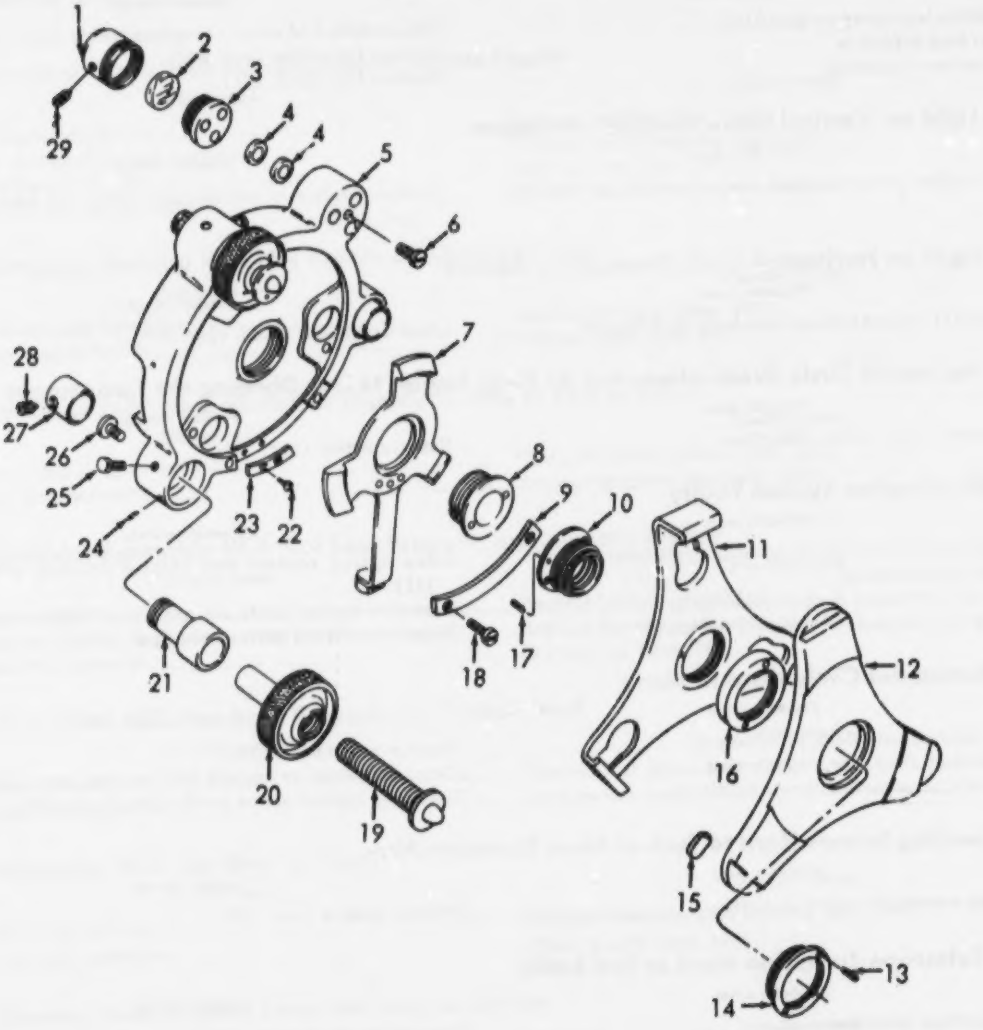
101. Tribrach Clamp Lever Inoperative

Probable cause	*Possible remedy*
Tribrach clamp lever loose or defective	Tighten or replace clamp lever (par. 103).

Section V. TRIBRACH ASSEMBLY

102. General

The tribrach, leveling screw, and star plate assembly form a leveling base between the bottom of the theodolite and the tripod head. The tribrach contains the circular level, which shows when the tribrach (and, therefore, the



EMC 6675-232-15/40

1	**Level housing**
2	**Circular level vial**
3	**Level base**
4	**Spring cup washer (6 rqr)**
5	**Tribrach**
6	**Screw (3 rqr)**
7	**Clamp lever**
8	**Nut**
9	**Stop plate**
10	**Nut**
11	**Spring plate**
12	**Star plate**
13	**Screw**
14	**Stop nut**
15	**Foot pad (3 rqr)**
16	**Locknut**
17	**Setscrew**
18	**Machine screw (2 rqr)**
19	**Leveling screw (3 rqr)**
20	**Leveling screw (3 rqr)**
21	**Nut (3 rqr)**
22	**Screw (2 rqr)**
23	**Stop lock**
24	**Setscrew (3 rqr)**
25	**Adjusting screw (3 rqr)**
26	**Screw (3 rqr)**
27	**Cover (3 rqr)**
28	**Screw**
29	**Screw**

Figure 40. Tribrach assembly, disassembly and reassembly.

theodolite itself) is level. The leveling screws are mounted in the three mounting lobes of the tribrach, with their other ends clamped snugly against the star plate. Adjusting one or more of the leveling screws either up or down, will bring the tribrach to a level position.

103. Tribrach Assembly

a. Removal. Remove the tribrach assembly (par. 61).

b. Disassembly. Refer to figure 40 and disassemble the tribrach assembly.

c. Cleaning, Inspection, and Repair.

(1) Clean all metal parts with an approved cleaning solvent. Clean the circular level glass with a soft cloth or tissue.

(2) Inspect all threaded parts for worn or damaged threads. Inspect the star plate and spring plate for dents, cracks, breaks, and burs. Inspect the tribrach for cracks and breaks. Inspect the clamp lever for burs and wear. Inspect the leveling screw components for binding or loose fit.

(3) Remove all burred edges and minor dents.

(4) Replace defective parts that cannot be repaired.

d. Reassembly. Refer to figure 40 and reassemble the tribrach assembly.

e. Installation. Install the tribrach assembly (par. 61)

f. Adjustment. Adjust the circular level (par. 17)

Section VI. COLLIMATION LEVEL COVER, COLLIMATION LEVEL MIRROR, AND ILLUMINATION MIRROR AND RETICLE MIRROR ASSEMBLIES

104. General

The collimation level mirror enables the operator of the theodolite to observe the position of the vertical collimation level bubble. The illumination mirror assembly is located on the left-side cover of the U-standard. It is used to light the vertical and horizontal circles during daylight operations. The reticle mirror assembly is located in the top of the telescope axis and provides illumination of the reticle when the electric illumination system is used. The collimation level cover is located on the left side of the U-standard directly below the collimation level mirror.

105. Collimation Level Cover and Collimation Level Mirror

a. Removal and Disassembly. Refer to figure 41 and remove and disassemble the collimation level cover and collimation level mirror.

b. Cleaning, Inspection, and Repair.

(1) Clean all metal parts with an approved cleaning solvent. Polish the metal mirror and glass windows with a soft cloth or tissue.

(2) Inspect the parts for burred edges and dents. Remove burs and any minor dents. Inspect the screws and threaded parts for worn or damaged threads. Inspect the mirror and windows for scratches or etching. Polish with a nonabrasive polishing compound.

(3) Replace all defective parts which are beyond repair.

c. Reassembly and Installation. Refer to figure 41 and reassemble and install the collimation level mirror and collimation level cover.

106. Illumination Mirror Assembly

a. Removal and Disassembly. Refer to figure 41 and remove and disassemble the illumination mirror assembly.

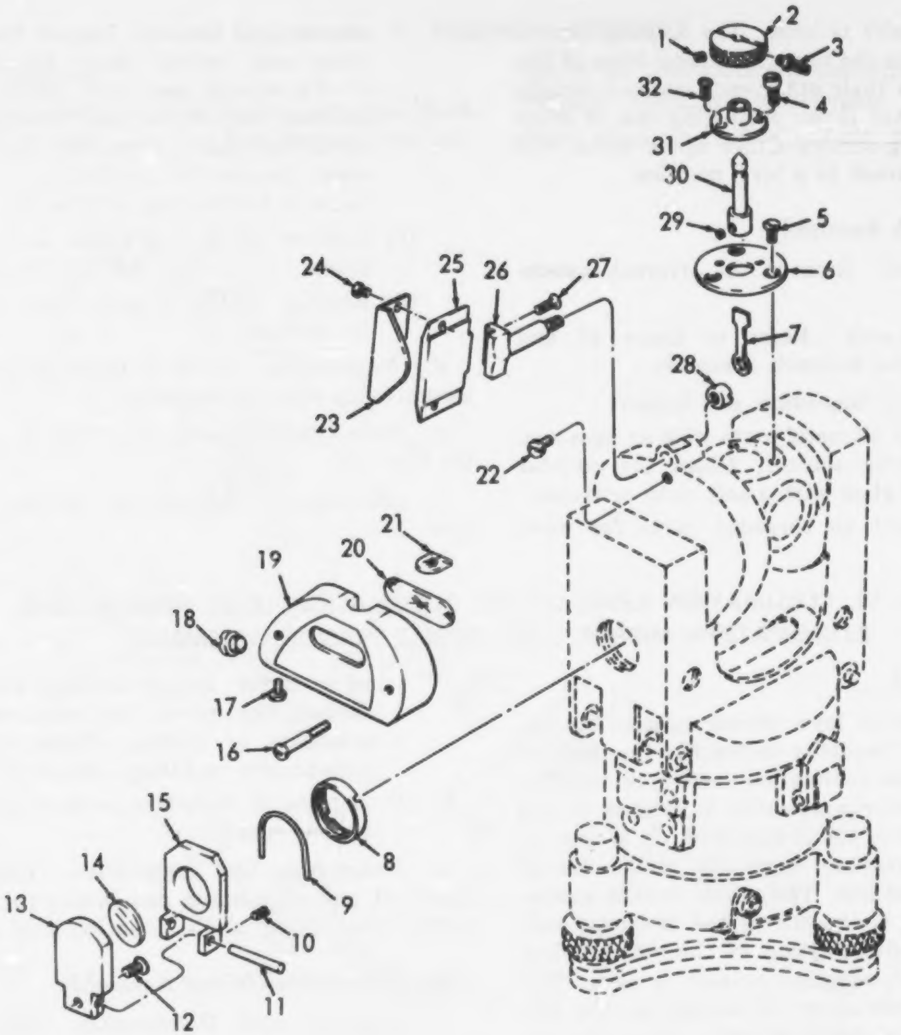
b. Cleaning and Inspection.

(1) Clean all metal parts with an approved cleaning solvent. Clean the mirror with a soft cloth moistened with an approved glass cleaner.

(2) Inspect the mirror for cracks, breaks, scratches, and loose backing. Inspect the mirror housing and sleeve for bends, cracks, and scored or worn bearing surfaces. Inspect the pin for wear and scoring.

(3) Remove burred edges and minor dents. Lubricate the hinge pin sparingly.

(4) Replace a broken mirror.



EMC 6675-232-15/41

1	Screw (2 rqr)	12	Machine screw	23	Collimation level mirror cover
2	Knob	13	Mirror housing	24	Machine screw (2 rqr)
3	Stop pin	14	Illumination mirror	25	Collimation level mirror
4	Screw (2 rqr)	15	Sleeve	26	Mirror axis
5	Machine screw (3 rqr)	16	Screw (2 rqr)	27	Screw (2 rqr)
6	Cover	17	Screw (2 rqr)	28	Nut
7	Mirror	18	Screw	29	Setscrew
8	Threaded bushing	19	Collimation level cover	30	Mirror shaft
9	Retaining clip	20	Side window	31	Bearing
10	Setscrew	21	Upper window	32	Screw
11	Pin	22	Stop screw		

Figure 41. Collimation level cover, collimation level mirror, and illumination mirror and reticle mirror assemblies, removal, disassembly, reassembly, and installation.

c. Reassembly and Installation. Refer to figure 41 and reassemble and install the illumination mirror assembly.

107. Reticle Mirror Assembly

a. Removal and Disassembly. Refer to figure 41 and remove and disassemble the reticle mirror assembly.

b. Cleaning, Inspection, and Repair.

(1) Clean all parts with an approved cleaning solvent. Polish the metal mirror with a soft cloth or tissue.

(2) Inspect the mirror for damage. Inspect the hardware for worn or damaged threads.

(3) Replace all defective parts that cannot be repaired.

c. Reassembly and Installation. Refer to figure 41 and reassemble and install the reticle mirror assembly.

Section VII. HORIZONTAL CIRCLE CLAMP AND HORIZONTAL CIRCLE PRISM ASSEMBLIES

108. Horizontal Circle Clamp Assembly

a. General. The horizontal circle clamp assembly is located in the upper part of the horizontal circle housing at the rear of the theodolite. Its function is to clamp the horizontal circle in position for reference during operation of the theodolite.

b. Removal. Refer to figure 42 and remove the horizontal circle clamp assembly.

c. Disassembly. Refer to figure 43 and disassemble the horizontal circle clamp assembly.

d. Cleaning, Inspection, and Repair.

(1) Clean all parts with an approved cleaning solvent.

(2) Inspect the springs for excessive wear or damage. Inspect all hardware for excessive wear and damaged threads. Inspect the clamp lever and bearing for burs, dents, and scratches. Inspect the lever axis for wear and rough surfaces.

(3) Remove all burs and minor dents.

(4) Replace all defective parts that cannot be repaired.

e. Reassembly. Refer to figure 43 and reassemble the horizontal circle clamp assembly.

f. Installation. Refer to figure 42 and install the horizontal circle clamp assembly.

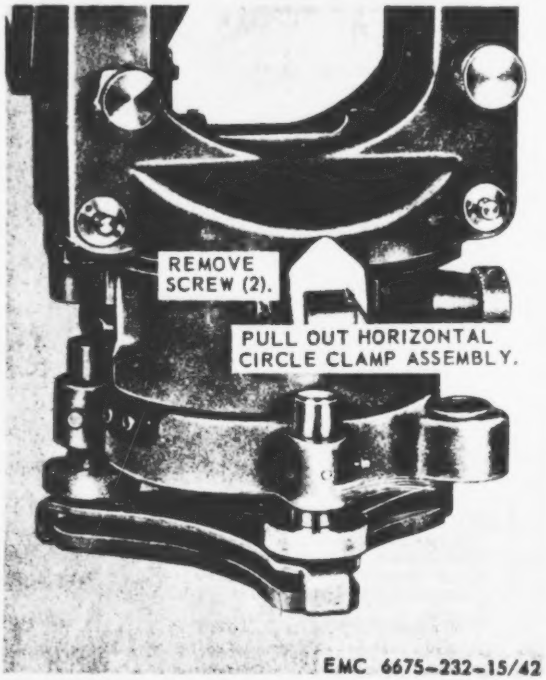


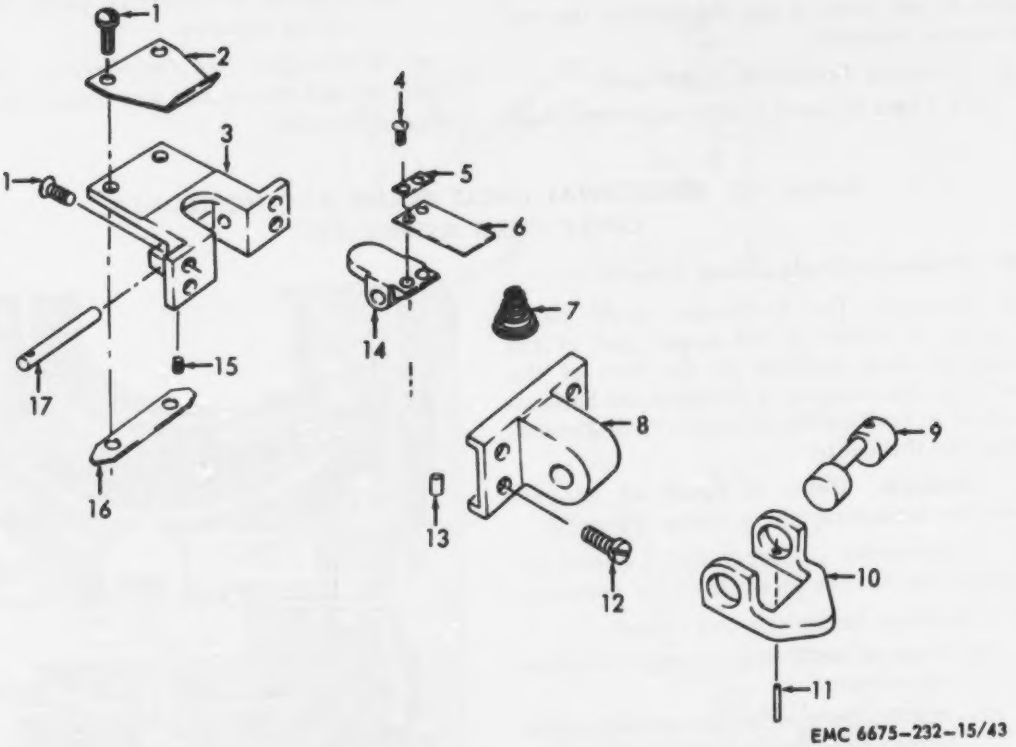
Figure 42. Horizontal circle clamp assembly, removal and installation.

109. Horizontal Circle Prism Assembly

a. General. The horizontal circle prism assembly is located on the left side of the theodolite in the upper part of the horizontal circle housing. It consists of a cover, prism housing, metal prisms, glass prism, and adjusting and attaching hardware. This prism assembly transmits the horizontal circle scale readings to the reading lens assembly.

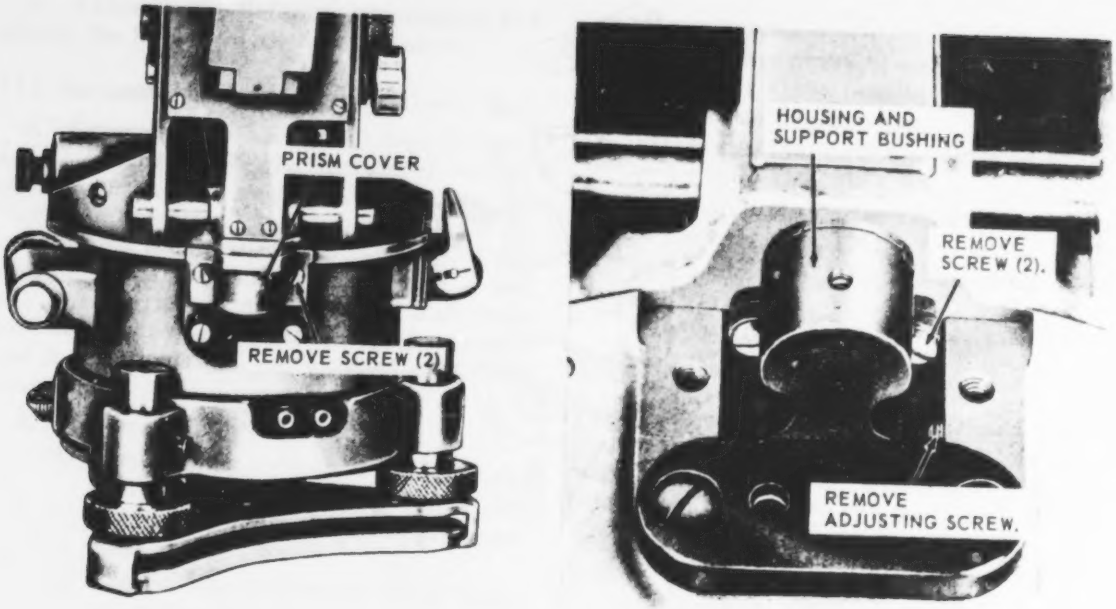
b. Removal. Refer to figure 44 and remove the horizontal circle prism assembly.

c. Disassembly. Refer to figure 45 and disassemble the horizontal circle prism assembly.


1
2
4
3
1
5
6
14
7
15
17
8
9
16
13
12
10
11
EMC 6675-232-15/43

1 Machine screw (4 rqr)
2 Clamp spring
3 Clamp bushing
4 Machine screw (2 rqr)
5 Clamp spring cover
6 Spring
7 Spring
8 Bearing
9 Clamp lever axis
10 Clamp lever
11 Pin
12 Machine screw (2 rqr)
13 Pin
14 Clamp lever
15 Screw
16 Plate
17 Pin

Figure 43. Horizontal circle clamp assembly, disassembly and reassembly.


PRISM COVER
REMOVE SCREW (2)
HOUSING AND SUPPORT BUSHING
REMOVE SCREW (2).
REMOVE ADJUSTING SCREW.

A. PRISM COVER.

B. HOUSING AND SUPPORT BUSHING.

EMC 6675-232-15/44

Figure 44. Horizontal circle prism assembly, removal and installation.

d. Cleaning, Inspection, and Repair.

(1) Clean all metal parts with an approved cleaning solvent. Clean and polish the glass prism with a chamois, soft cloth, or lens tissue.

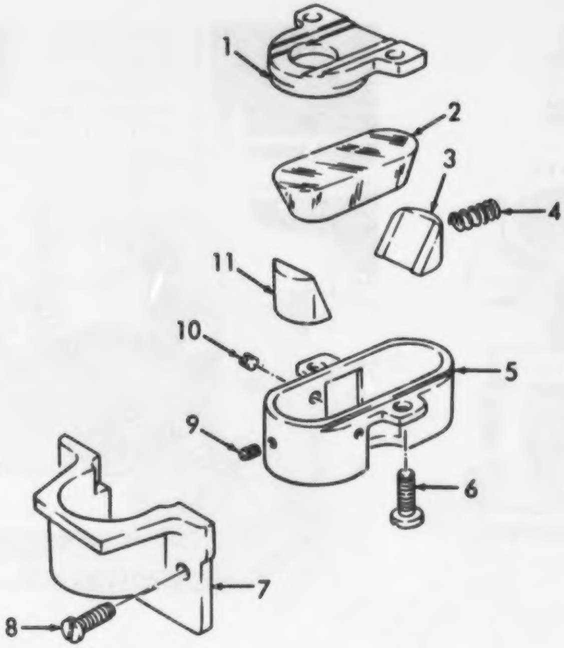
(2) Inspect the prisms and prism housings for cracks, burs, and damaged surfaces. Inspect all hardware for worn or damaged threads.

(3) Remove all burs.

(4) Replace all defective parts that cannot be repaired.

e. Reassembly. Refer to figure 45 and reassemble the horizontal circle prism assembly.

f. Installation. Refer to figure 44 and install the horizontal circle prism assembly.



ENC 6675-200-15/27

1 Support bushing
2 Glass prism
3 Metal prism
4 Compression spring
5 Prism housing
6 Machine screw (2 rqr)
7 Prism housing cover
8 Screw (2 rqr)
9 Screw
10 Setscrew
11 Metal prism

Figure 45. Horizontal circle prism assembly, disassembly and reassembly.

Section VIII. HORIZONTAL SLOW-MOTION SCREW, HORIZONTAL CIRCLE HOUSING AND INNER BASE, HORIZONTAL CLAMP, AND HORIZONTAL CIRCLE ASSEMBLY AND OUTER VERTICAL AXIS

110. Horizontal Slow-Motion Screw Assembly

a. General. The horizontal slow-motion screw assembly permits the operator of the theodolite to make slow and precise lateral corrections to the azimuth of the telescope after making a rough sighting to the target.

b. Removal and Disassembly. Refer to figure 46 and remove and disassemble the horizontal slow-motion screw assembly.

c. Cleaning, Inspection, and Repair.

(1) Clean all parts with an approved cleaning solvent and dry thoroughly. Remove all grease and foreign matter from inside the housing, spring, and spring housing. Thoroughly clean the lead screw, stop nut, and threaded bushing.

(2) Inspect all threaded surfaces for worn or damaged threads. Inspect the spring for wear, breaks, and collapsed coils. Inspect the pin and housings for burs, cracks, and bends. Inspect the lead screw and stop nut for burs, wear, and damage.

(3) Remove all burs.

(4) Replace all defective parts that cannot be repaired.

d. Reassembly and Installation. Refer to figure 46 and reassemble and install the horizontal slow-motion screw assembly.

e. Adjustment. Refer to paragraph 17 and adjust the horizontal slow-motion screw.

111. Horizontal Circle Housing and Inner Base

a. General. The horizontal circle housing and inner base include the instrument receptacles, contacts, and electrical connections for nighttime operation, the horizontal clamp assembly, and the vertical axis assembly. Components of the horizontal circle are also included. The horizontal circle housing and inner base are located between the tribrach assembly and the U-standard when installed on the instrument.

b. Removal.

(1) Remove the tribrach assembly (par. 61).

(2) Remove the horizontal circle clamp assembly (par. 108).

(3) Remove the horizontal circle prism assembly (par. 109).

(4) Refer to figure 47 and remove the horizontal circle housing and inner base as a unit.

c. Disassembly. Refer to figure 46 and disassemble the horizontal circle housing and inner base.

d. Cleaning, Inspection, and Repair.

(1) Clean all metal parts with an approved cleaning solvent and dry thoroughly. Remove dirt and foreign matter from the electrical receptacles, cables, and contacts.

(2) Inspect the horizontal circle housing and inner base for cracks, burs, dents, and other damage. Inspect the electrical cables for damaged insulation and broken or frayed wires. Inspect the receptacles for cracks, breaks, and damaged terminals. Inspect the clamp assembly for burs and excessive wear. Inspect all hardware for damaged threads and heads.

(3) Remove all burs and minor dents.

(4) Replace all defective parts that cannot be repaired.

e. Reassembly. Refer to figure 46 and reassemble the horizontal circle housing and inner base.

f. Installation.

(1) Refer to figure 47 and install the horizontal circle housing and inner base as a unit.

(2) Install the horizontal circle prism assembly (par. 109).

(3) Install the horizontal circle clamp assembly (par. 108).

(4) Install the tribrach assembly (par. 61).

112. Horizontal Clamp Assembly

a. General. The horizontal clamp assembly, located on the right side of the horizontal circle housing assembly, serves to lock the rotatable U-standard in any horizontal position until the clamp is released.

b. Removal and Disassembly.

(1) Remove horizontal circle housing (par. 111).

(2) Refer to figure 46 and remove and disinstall the horizontal clamp assembly.

c. Cleaning, Inspection, and Repair.

(1) Clean all parts with an approved cleaning solvent.

(2) Inspect the knob, bushing, pin, horizontal clamp, clamp jaw, and tube connector for burs, dents, and excessive wear. Inspect the lockring, clamp, and clamp lever for cracks and breaks.

(3) Remove all burs, dents, and nicks.

(4) Replace all defective parts that cannot be repaired.

d. Reassembly and Installation.

(1) Refer to figure 46 and reassemble and install the horizontal clamp assembly.

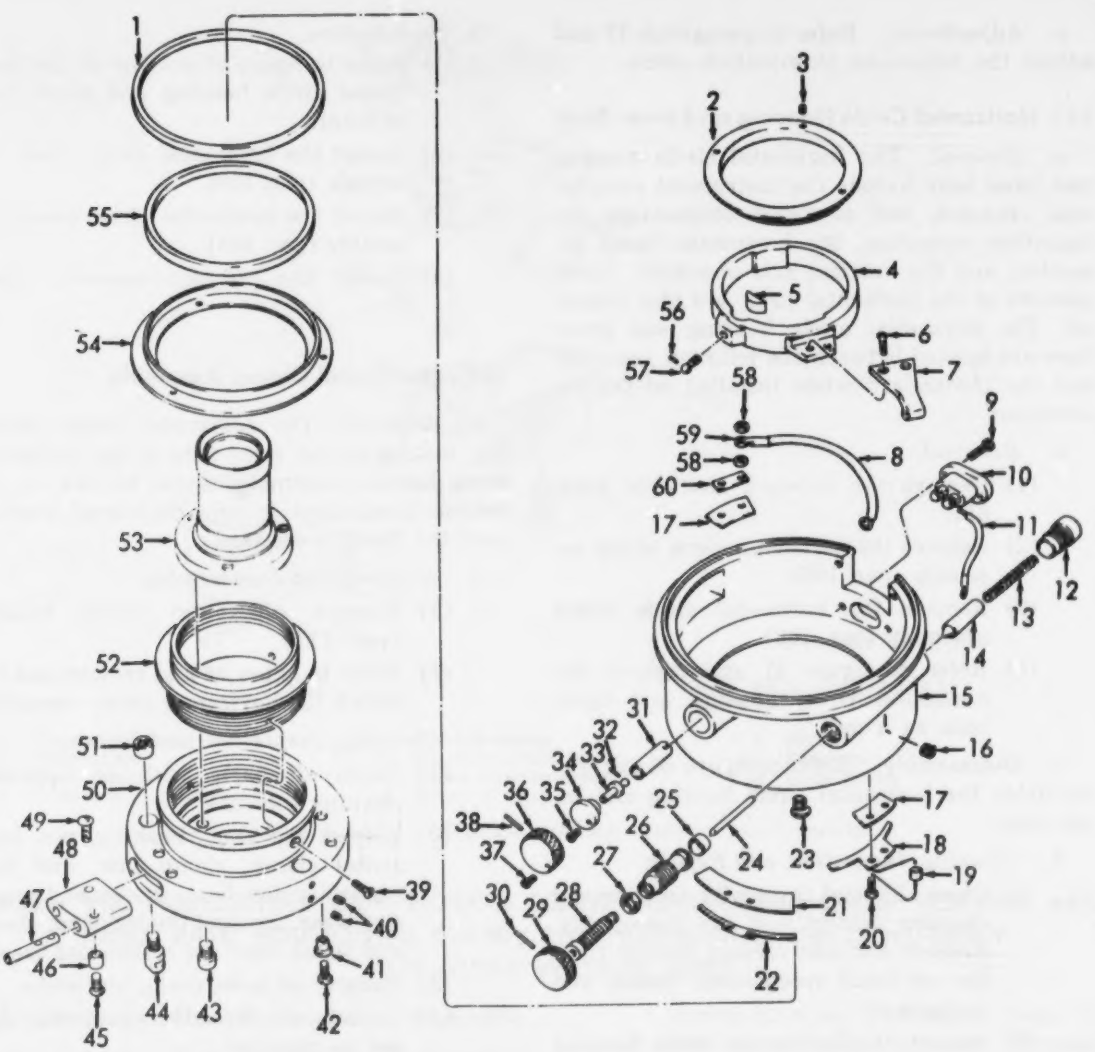
(2) Install the horizontal circle housing (par. 111).

113. Horizontal Circle Assembly and Outer Vertical Axis

a. Removal.

(1) Remove the horizontal circle housing (par. 111).

(2) Refer to figure 48 and remove the horizontal circle assembly and outer vertical axis as a unit.

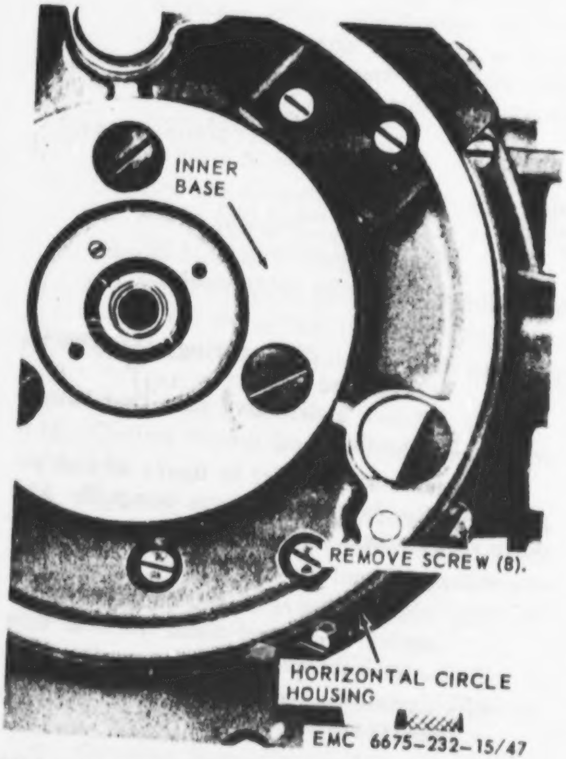

1
55
54
53
52
51
50
49
48
47
46
45
44
43
42
41
40
39
3
2
4
5
56
57
6
7
58
59
58
60
17
8
9
10
11
12
13
14
15
16
31
32
33
34
35
36
38
37
25
26
27
24
23
17
18
19
21
20
30
29
28
22

EMC 6675-232-15/46

Figure 46. Horizontal clamp, horizontal slow-motion screw, horizontal circle housing and inner base housing assemblies, removal, disassembly, reassembly, and installation.

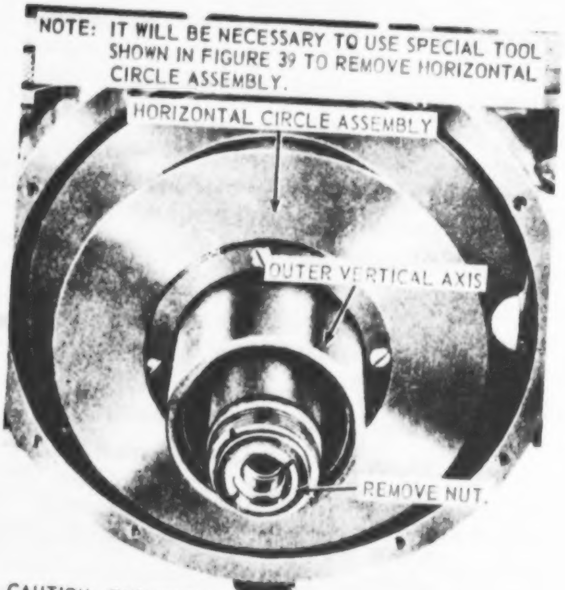
1 Outer contact ring
2 Lockring
3 Setscrew
4 Horizontal clamp
5 Horizontal clamp jaw
6 Machine screw (2 rqr)
7 Clamp lever
8 Electrical cable
9 Machine screw (2 rqr)
10 Housing plug
11 Electrical cable
12 Housing
13 Helical compression spring
14 Spring housing
15 Horizontal circle housing
16 Setscrew
17 Insulating plate (2 rqr)
18 Spring contact
19 Insulating bushing (4 rqr)
20 Machine screw (spec) (4 rqr)
21 Insulating plate (2 rqr)
22 Spring contact
23 Setscrew (5 rqr)
24 Pin
25 Stop nut
26 Bushing
27 Locknut
28 Lead screw
29 Knob
30 Pin
31 Tube connector
32 Pin
33 Pin
34 Bushing
35 Machine screw (spec)
36 Clamp knob
37 Machine screw (spec)
38 Pin
39 Machine screw (spec) (3 rqr)
40 Setscrew (6 rqr)
41 Insulating bushing (4 rqr)
42 Machine screw (spec) (4 rqr)
43 Machine screw (3 rqr)
44 Spike foot (3 rqr)
45 Machine screw (spec) (2 rqr)
46 Insulating bushing (2 rqr)
47 Contact bushing (2 rqr)
48 Housing plug
49 Machine screw (spec) (2 rqr)
50 Inner base housing
51 Nut (spec) (3 rqr)
52 Inner base
53 Outer vertical axis
54 Insulating gasket
55 Inner contact ring
56 Pin
57 Clamp screw
58 Nut (spec) (8 rqr)
59 Cable terminal (4 rqr)
60 Contact plate (2 rqr)

Figure 46—Continued.



EMC 6675-232-15/47

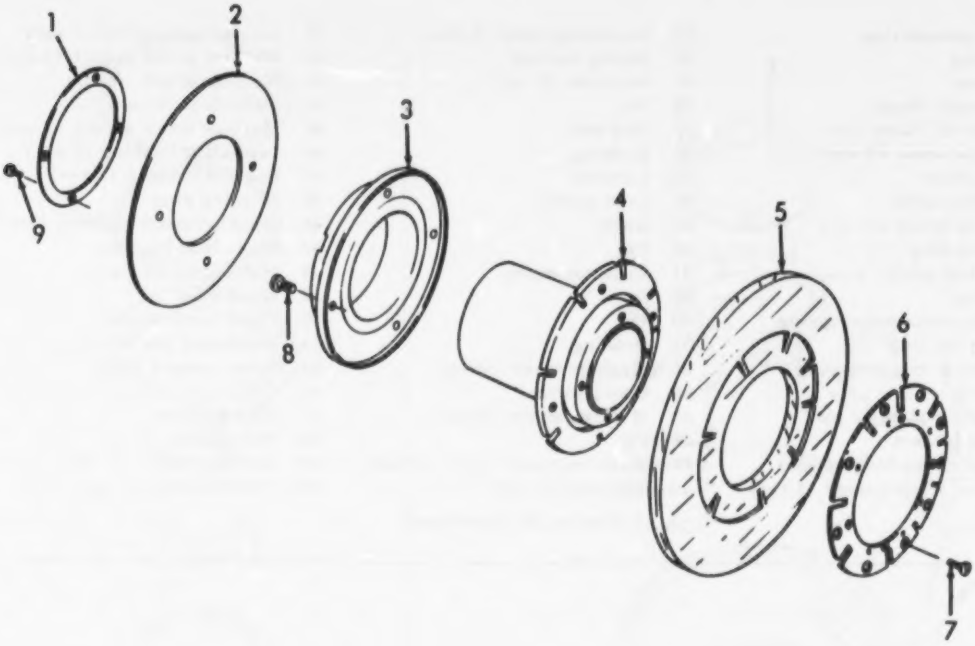
Figure 47. Horizontal circle housing and inner base, removal and installation.


NOTE: IT WILL BE NECESSARY TO USE SPECIAL TOOL SHOWN IN FIGURE 39 TO REMOVE HORIZONTAL CIRCLE ASSEMBLY.

CAUTION: EXERCISE CARE TO PREVENT OPTICAL PLUMB DEVICE FROM DROPPING OUT OF VERTICAL AXIS WHEN HORIZONTAL CIRCLE ASSEMBLY IS REMOVED.

EMC 6675-232-15/48

Figure 48. Horizontal circle assembly and outer vertical axis, removal and installation.



1	Clutch washer	4	Outer vertical axis	7	Screw (4 rqr)
2	Clutch disk	5	Horizontal circle	8	Screw (4 rqr)
3	Clutch bearing	6	Disk spring	9	Machine screw (4 rqr)

Figure 49. Horizontal circle assembly and outer vertical axis, disassembly and reassembly.

b. Disassembly. Refer to figure 49 and disassemble the horizontal circle assembly and outer vertical axis.

c. Cleaning, Inspection, and Repair.

(1) Clean all metal parts with an approved cleaning solvent. Clean the horizontal circle assembly with a clean, soft cloth moistened with grain alcohol or acetone.

(2) Inspect the circle for breaks, cracks, etching, or other damage. Inspect hardware for damaged threads. Inspect the disk spring for cracks, breaks, and bends.

(3) Replace a defective part that cannot be repaired.

d. Reassembly. Refer to figure 49 and reassemble the horizontal circle assembly and outer vertical axis.

e. Installation.

(1) Refer to figure 48 and install the horizontal circle and outer vertical axis assemblies as a unit.

(2) Install the horizontal circle housing (par. 111).

Section IX. OPTICAL PLUMB DEVICE AND EYEPIECE ASSEMBLY AND INNER VERTICAL AXIS

114. Optical Plumb Device

a. General. The optical plumb prism, reticle, and magnifying lens assemblies, with associated sleeves and housings, comprise the optical plumb device. The inner vertical axis of the theodolite houses the optical plumb device.

b. Removal and Disassembly.

(1) Remove the horizontal circle assembly (par. 113).

(2) Refer to figure 50 and remove and disassemble the optical plumb device.

c. Cleaning, Inspection, and Repair.

(1) Clean all metal parts with an approved cleaning solvent and dry thoroughly. Clean the lens and prisms with lens tissue moistened with grain alcohol or acetone.

(2) Inspect the lens and prisms for scratches, chips, and cracks. Inspect all threaded parts for worn or damaged threads. Inspect the prism housing and lens holder tube for cracks, burs, and breaks.

(3) Remove all burs.

(4) Replace all defective parts that cannot be repaired.

d. Reassembly and Installation.

(1) Refer to figure 50 and reassemble and install the optical plumb device.

(2) Install the horizontal circle assembly (par. 113).

115. Optical Plumb Device Eyepiece Assembly

a. General. The optical plumb device eyepiece assembly is located on the front of the U-standard near the bottom. It enables the operator to center the instrument accurately over the station point.

b. Removal and Disassembly. Refer to figure 50 and remove and disassemble the optical plumb device eyepiece assembly.

c. Cleaning, Inspection, and Repair.

(1) Clean all metal parts with an approved cleaning solvent. Clean the lens with lens tissue moistened with grain alcohol or acetone.

(2) Inspect the lens for scratches, chipping, and cracks. Inspect all threaded parts for worn or damaged threads. Inspect the lens holder tube for burs, dents, cracks, and breaks.

(3) Remove all burs.

(4) Replace all defective parts that cannot be repaired.

d. Reassembly and Installation. Refer to figure 50 and reassemble and install the optical plumb device eyepiece assembly.

e. Adjustment. Refer to paragraph 17 and adjust the optical plumb device.

116. Inner Vertical Axis

a. General. The inner vertical axis is fastened to the bottom of the U-standard, serving as the pivot upon which the U-standard turns. It provides mounting for the optical plumb device described in paragraph 114. The inner vertical axis also houses two adjusting screws and spring-actuated pins which are used to position and hold the optical plumb prism in alinement.

b. Removal and Disassembly.

(1) Remove the horizontal circle assembly (par. 113).

(2) Remove the optical plumb device (par. 114).

(3) Remove the optical plumb device eyepiece assembly (par. 115).

(4) Refer to figure 50 and remove and disassemble the inner vertical axis.

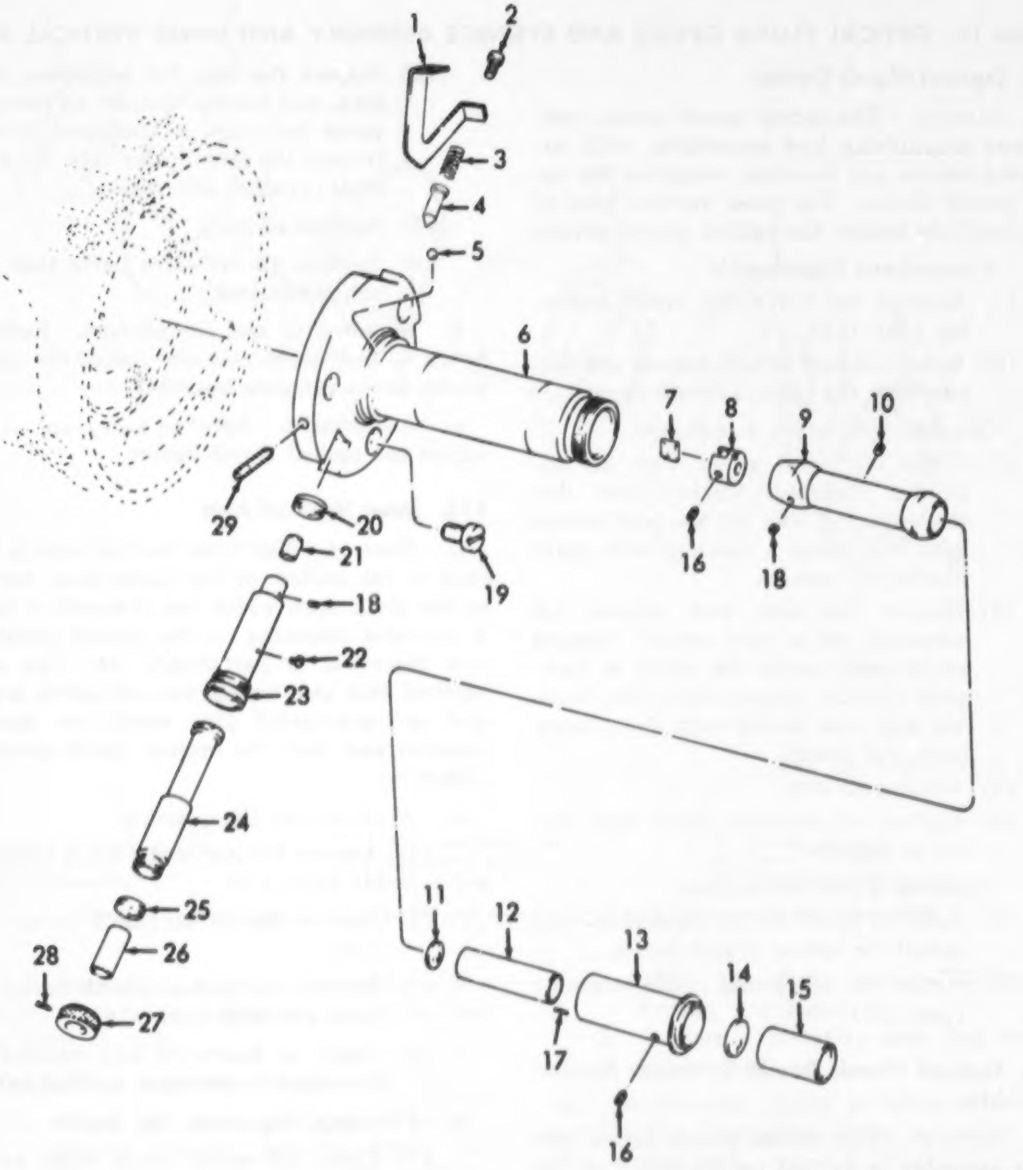
c. Cleaning, Inspection, and Repair.

(1) Clean all metal parts with an approved cleaning solvent. Clean the 25 ball bearings with a lint-free cloth moistened with an approved cleaning solvent.

(2) Inspect the axis for damaged threads, burs, nicks, and wear. Inspect the ball bearings for flat spots, roughness, and other signs of wear.

(3) Remove all burs and nicks.

(4) Replace all defective parts that cannot be repaired.


1
2
3
4
5
6
7
8
9
10
16
18
29
20
21
19
18
22
23
24
25
26
28
27
11
12
13
14
15
17
16
EMC 6675-200-15/32

1	**Stop plate**
2	**Machine screw (2 rqr)**
3	**Spring (2 rqr)**
4	**Pin (2 rqr)**
5	**Bearing, ball (25 rqr)**
6	**Inner vertical axis**
7	**Prism**
8	**Prism housing**
9	**Sleeve**
10	**Setscrew**
11	**Reticle**
12	**Mount**
13	**Sleeve**
14	**Lens**
15	**Mount**
16	**Setscrew (3 rqr)**
17	**Pin**
18	**Setscrew (2 rqr)**
19	**Machine screw (3 rqr)**
20	**Lens assembly**
21	**Lens housing**
22	**Setscrew**
23	**Sleeve**
24	**Tube**
25	**Lens assembly**
26	**Lens tube**
27	**Nut**
28	**Setscrew**
29	**Adjusting screw (2 rqr)**

Figure 50. Optical plumb device and eyepiece assembly, and inner vertical axis, removal, disassembly, reassembly, and installation.

d. Reassembly and Installation.

(1) Refer to figure 50 and reassemble and install the inner vertical axis.

(2) Refer to paragraph 115 and install the optical plumb device eyepiece assembly.

(3) Refer to paragraph 114 and install the optical plumb device.

(4) Refer to paragraph 113 and install the horizontal circle assembly.

Section X. PLATE LEVEL ASSEMBLY AND CLAMP PINS

117. Plate Level Assembly

a. General. The plate level assembly is mounted on the base of the U-standard between the upright members. It indicates when the theodolite has been brought to a horizontal position by means of adjustment of the leveling screws.

b. Removal. Refer to figure 51 and remove the plate level assembly.

c. Disassembly. Refer to figure 52 and disassemble the plate level assembly.

d. Cleaning, Inspection, and Repair.

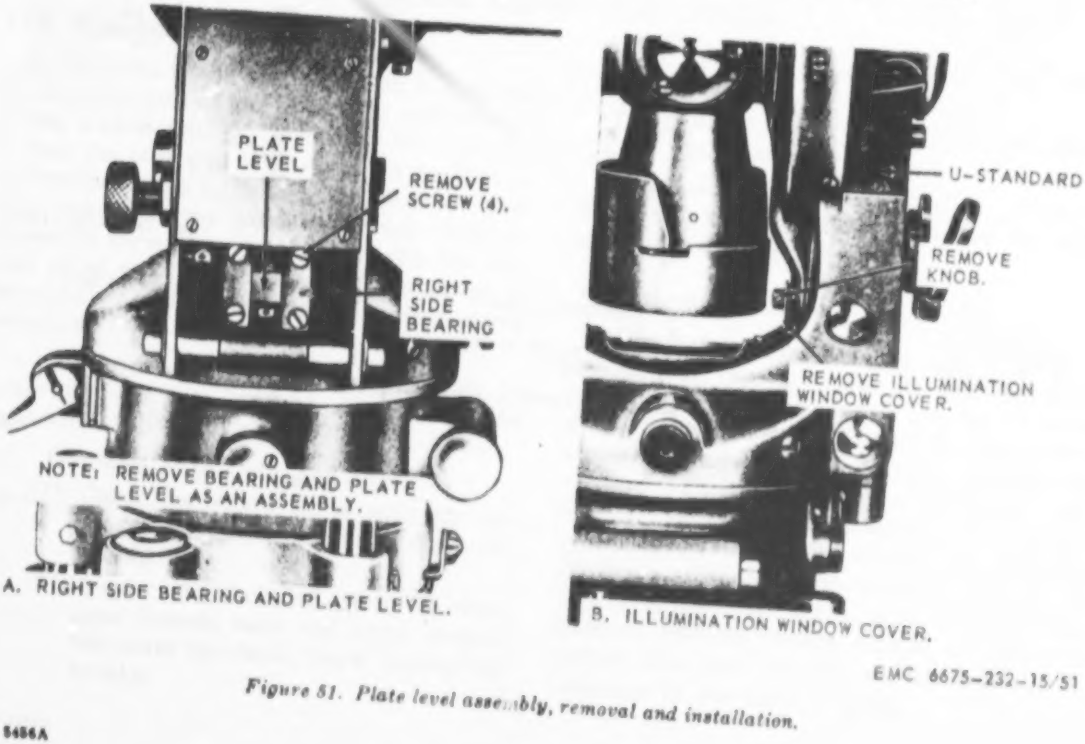
(1) Clean all metal parts with an approved cleaning solvent and dry thoroughly. Wipe off the vial and plastic vial cover with a soft cloth moistened with grain alcohol.

(2) Inspect the vial for cracks, etching, and defective bubble. Inspect the vial cover for cracks, splits, scratches, and chipping. Inspect the tube and bearings for cracks, burs, and breaks. Inspect the spring for wear and fatigue. Inspect the vial end caps for damage. Inspect the screws for worn or damaged threads.

(3) Remove all nicks and burs.

(4) Replace all defective parts that cannot be repaired.

e. Reassembly. Refer to figure 52 and reassemble the plate level assembly.

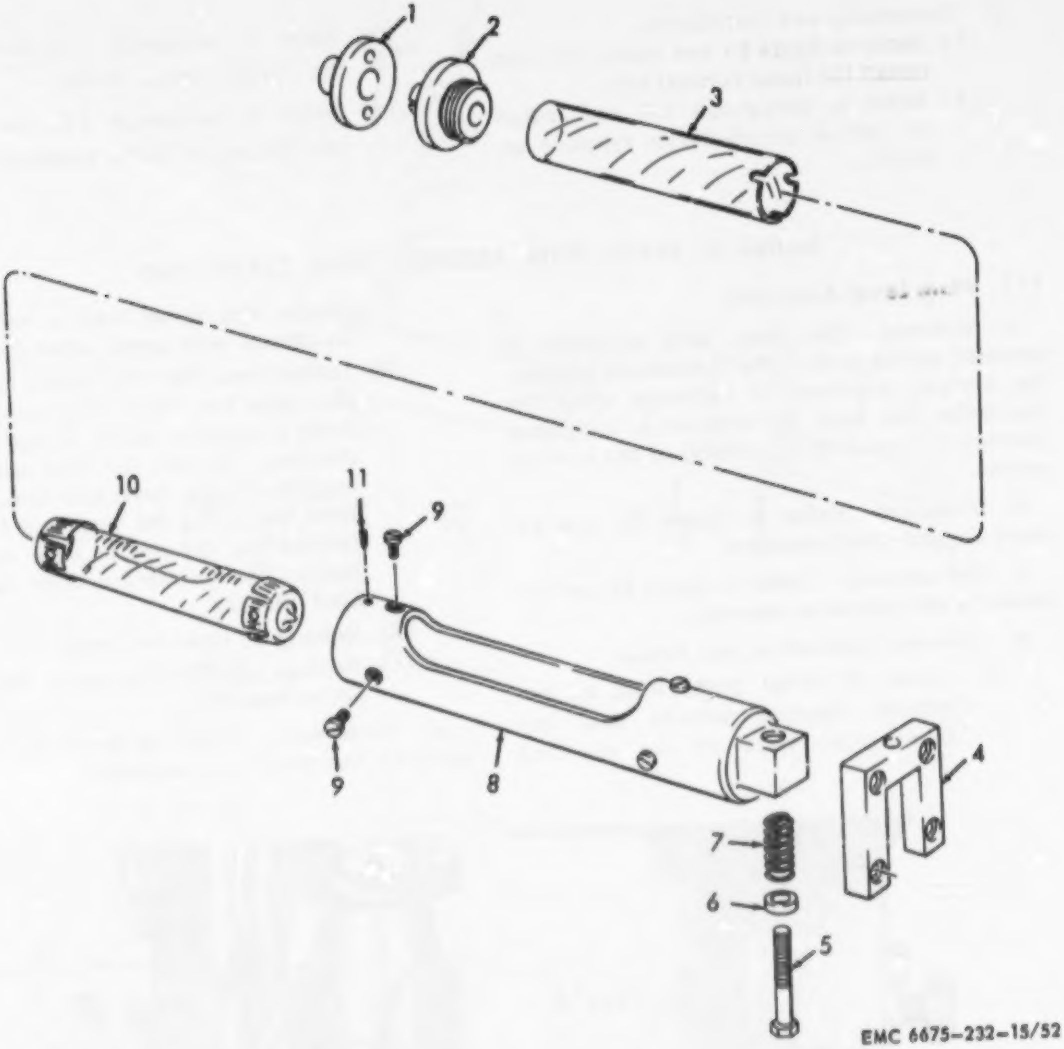


A. RIGHT SIDE BEARING AND PLATE LEVEL.

B. ILLUMINATION WINDOW COVER.

EMC 6675-232-15/51

Figure 51. Plate level assembly, removal and installation.


1
2
3
10
11
9
8
9
4
7
6
5
EMC 6675-232-15/52

1 Bearing
2 Sleeve
3 Plastic vial cover
4 Bearing
5 Adjusting screw
6 Washer
7 Compression spring
8 Level tube
9 Machine screw (4 rqr)
10 Vial level
11 Setscrew

Figure 52. Plate level assembly, disassembly and reassembly.

f. Installation. Refer to figure 51 and install the plate level assembly.

g. Adjustment. Refer to paragraph 17 and adjust the plate level.

118. Clamp Pins

a. General. The four clamp pins mounted on each corner of the U-standard are used to hold the theodolite securely in the base of the carrying case when engaged by the clamp levers.

b. Removal. Refer to figure 53 and remove the clamp pins.

c. Cleaning and Inspection.

(1) Clean the metal parts with an approved cleaning solvent.

(2) Inspect the clamp pins for burs, nicks, and damaged threads.

(3) Remove all burs and nicks.

(4) Replace a defective clamp pin.

d. Installation. Refer to figure 53 and install the clamp pins.

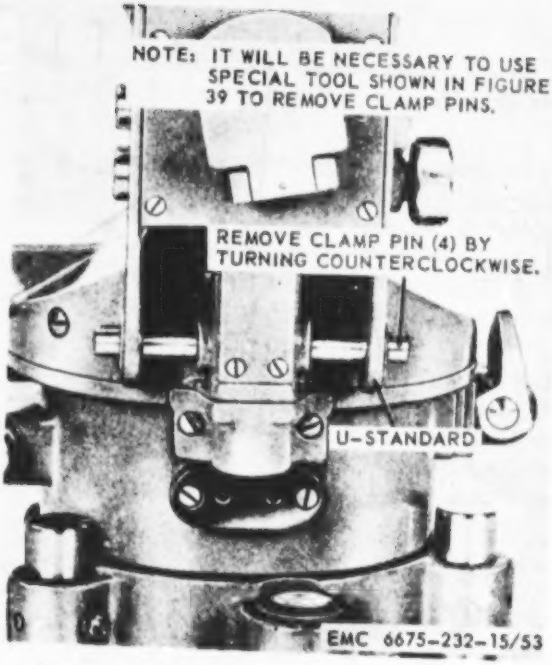

NOTE: IT WILL BE NECESSARY TO USE SPECIAL TOOL SHOWN IN FIGURE 39 TO REMOVE CLAMP PINS.
REMOVE CLAMP PIN (4) BY TURNING COUNTERCLOCKWISE.
U-STANDARD
EMC 6675-232-15/53

Figure 53. Clamp pins, removal and installation.

Section XI. RIGHT-SIDE SUPPORT COVER, VERTICAL CLAMP, AND VERTICAL SLOW-MOTION SCREW

119. Right-Side Support Cover

a. General. The vertical clamp is mounted on the right side of the theodolite near the top of the U-standard. It is used by the operator to hold the telescope in any desired position in the vertical plane by locking the telescope axis. The vertical clamp screw and stop ring are accessible from the outside; the right-side support cover must be removed to gain access to the remaining components of the vertical clamp assembly.

b. Removal and Disassembly. Refer to figure 54 and remove and disassemble the right-side support cover.

c. Cleaning, Inspection, and Repair.

(1) Clean the metal parts with an approved cleaning solvent and dry thoroughly.

(2) Inspect the threaded parts for damaged threads, burs, and nicks. Inspect the cover for dents, burs, cracks, and breaks.

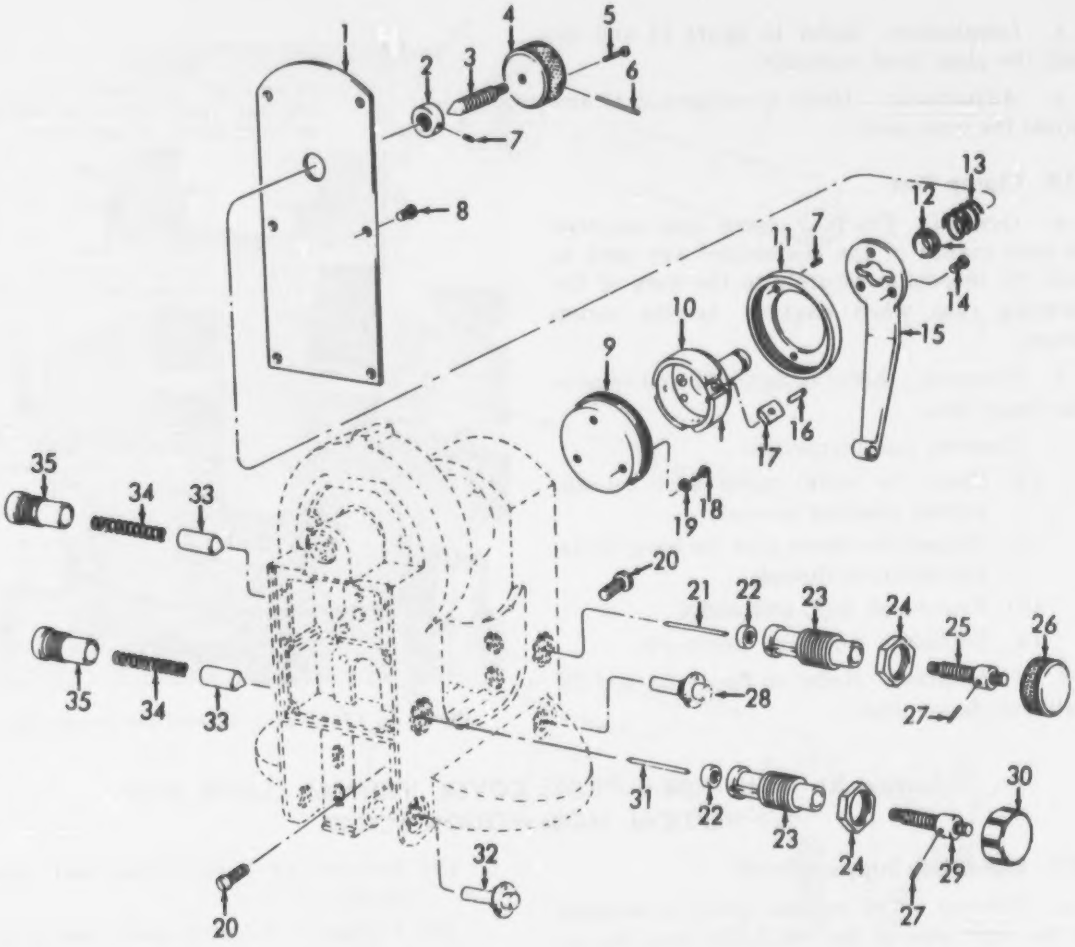
(3) Remove all burs, nicks, and minor dents.

(4) Replace a defective part that cannot be repaired.

d. Reassembly and Installation. Refer to figure 54 and reassemble and install the right-side support cover.

120. Vertical Clamp

a. General. The vertical clamp lever is mounted on the right side of the U-standard beneath the right-side support cover. It transmits the action of the vertical slow-motion screw to the telescope axis when making fine vertical adjustments of the telescope. The vertical clamp, located behind the vertical clamp lever, serves to clamp the telescope firmly in position at any desired point in the vertical plane. The clamp also works in conjunction with the vertical slow-motion screw to permit slow and precise adjustments of the telescope in the vertical plane.


1
2
3
4
5
6
7
8
13
12
7
11
14
10
15
9
16
17
35
34
33
18
19
20
21
22
23
24
25
26
35
34
33
28
27
30
31
22
23
24
29
32
27
20

EMC 6675–232–15/54

1	Right-side support cover
2	Stop ring
3	Lockscrew
4	Knob
5	Setscrew
6	Pin
7	Setscrew (4 rqr)
8	Machine screw (6 rqr)
9	Housing
10	Vertical clamp
11	Threaded bushing
12	Washer
13	Spring
14	Machine screw (3 rqr)
15	Lever
16	Pin
17	Vertical clamp jaw
18	Machine screw (3 rqr)
19	Lockwasher (3 rqr)
20	Screw (spec) (2 rqr)
21	Pin
22	Nut (2 rqr)
23	Bushing (2 rqr)
24	Nut (2 rqr)
25	Lead screw
26	Knob
27	Pin (2 rqr)
28	Clamp pin (3 rqr)
29	Lead screw
30	Knob
31	Pin
32	Clamp pin
33	Spring housing (2 rqr)
34	Spring (2 rqr)
35	Housing (2 rqr)

Figure 54. Vertical clamp, vertical slow-motion screw, collimation slow-motion screw, and right-side support cover, removal, disassembly, reassembly, and installation.

b. Removal and Disassembly.

(1) Remove the right side support cover (par. 119).

(2) Refer to figure 54 and remove and disassemble the vertical clamp.

c. Cleaning, Inspection, and Repair.

(1) Clean all parts with an approved cleaning solvent and dry thoroughly.

(2) Inspect the spring for wear and fatigue. Inspect the arm for dents, burs, and bends. Inspect the mounting screws for damaged threads. Inspect the clamp and clamp housing for cracks, dents, and wear.

(3) Remove minor dents and burs.

(4) Replace all defective parts that cannot be repaired.

d. Reassembly and Installation.

(1) Refer to figure 54 and reassemble and install the vertical clamp.

(2) Refer to paragraph 119 and install the right-side support cover.

121. Vertical Slow-Motion Screw

a. General. The vertical slow-motion screw is located on the right side of the U-standard. It is used by the operator to make precise and final adjustments of the telescope position in the vertical plane.

b. Removal and Disassembly. Refer to figure 54 and remove and disassemble the vertical slow-motion screw.

c. Cleaning, Inspection, and Repair.

(1) Clean all parts with an approved cleaning solvent. Remove all grease and foreign matter from the inside of the spring housing. Thoroughly clean the lead screw, split nut, and screw bushing.

(2) Inspect all threaded surfaces for worn or damaged threads. Inspect the spring for wear or fatigue. Inspect the pin and housings for burs, cracks, and bends. Inspect the adjusting screw and split nut for burs, wear, and damage.

(3) Remove all burs.

(4) Replace all defective parts that cannot be repaired.

d. Reassembly and Installation. Refer to figure 54 and reassemble and install the vertical slow-motion screw.

e. Adjustment. Refer to paragraph 17 and adjust the vertical slow-motion screw.

Section XII. VERTICAL COLLIMATION LEVEL ASSEMBLY, LEFT-SIDE SUPPORT COVER, VERTICAL COLLIMATION HOUSING, VERTICAL COLLIMATION LEVER, VERTICAL CIRCLE, AND COLLIMATION SLOW-MOTION SCREW ASSEMBLIES

122. Vertical Collimation Level Assembly

a. General. The vertical collimation level is provided to enable the operator to establish an exact horizontal plane and to make precise measurements relative to that plane. It is located on the upper left side of the U-standard.

b. Removal.

(1) Remove the collimation level cover (par. 105).

(2) Refer to figure 55 and remove the vertical collimation level assembly.

c. Disassembly. Refer to figure 56 and disassemble the vertical collimation level assembly.

d. Cleaning, Inspection, and Repair.

(1) Clean all metal parts with an approved cleaning solvent. Clean and polish the prisms with lens tissue dipped in grain alcohol or acetone.

(2) Inspect the prisms for chips, scratches, and etchings. Inspect the housing, beam, vial cover, and prism plate for dents, burs, breaks, and excessive wear. Inspect the vial for cracks and etchings.

(3) Remove all burs. Replace all defective parts that cannot be repaired.

e. Reassembly. Refer to figure 56 and reassemble the vertical collimation level assembly.

f. Installation.

(1) Refer to figure 55 and install the vertical collimation level assembly.

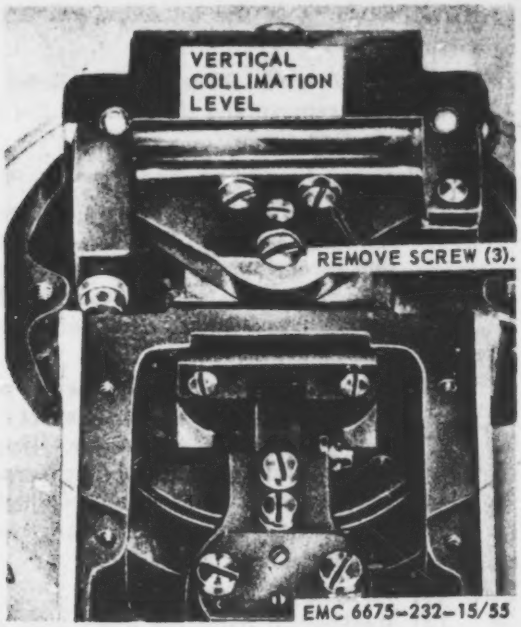


Figure 55. Vertical collimation level assembly, removal and installation.

(2) Install the collimation level cover (par. 105).

g. Adjustment. Refer to paragraph 17 and adjust the collimation level.

123. Left-Side Support Cover Assembly

a. General. The left-side support cover assembly contains the illumination mirror mount and plug-in lamp bushing. The left-side support cover also protects the collimination level arm assembly.

b. Removal and Disassembly.

(1) Remove the collimation level cover (par. 105).

(2) Refer to figure 57 and remove and disassemble the left-side support cover assembly.

c. Cleaning, Inspection, and Repair.

(1) Clean all metal parts with an approved cleaning solvent. Clean the glass window with lens tissue.

(2) Inspect the mirror mount, cover, and plug-in lamp bushing for dents, breaks, and excessive wear. Inspect all threaded surfaces for damaged threads and wear.

(3) Remove all burs. Replace defective parts that cannot be repaired.

d. Reassembly and Installation.

(1) Refer to figure 57 and reassemble and install the left-side support cover assembly.

(2) Install the collimation level cover (par. 105).

124. Vertical Collimation Housing and Vertical Collimation Lever Assemblies

a. General. The vertical collimation housing and vertical collimation lever assemblies are located in the left side of the U-standard and contain the upper and lower vertical circle reading prisms and lens assemblies, the upper horizontal circle reading prism assembly, prisms, and lenses.

b. Removal.

(1) Remove the collimation level mirror (par. 105).

(2) Remove the left-side support cover (par. 123).

(3) Remove the vertical collimation level assembly (par. 122).

(4) Remove the collimation slow-motion screw assembly (par. 126).

(5) Refer to figure 58 and remove the vertical collimation housing and vertical collimation lever as an assembly.

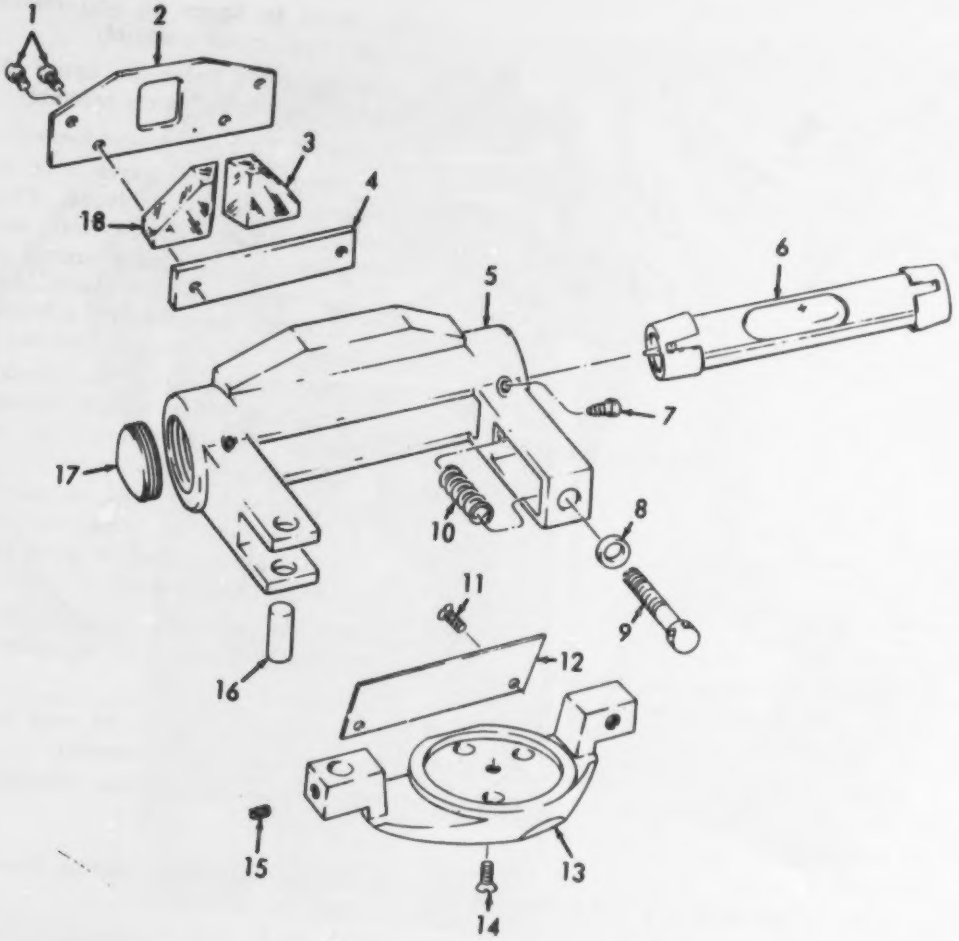
c. Disassembly. Refer to figure 59 and disassemble the vertical collimation housing and vertical collimation lever assemblies.

d. Cleaning, Inspection, and Repair.

(1) Clean all metal parts with an approved cleaning solvent. Clean and polish the prism and lenses with a lens tissue dipped in grain alcohol or acetone.

(2) Inspect the housings, bearing shell, and sleeves for cracks, dents, and excessive wear. Inspect the prisms and lenses for chips, cracks, and etching. Inspect all threaded surfaces for damaged threads and excessive wear.

(3) Replace all defective parts that cannot be repaired.



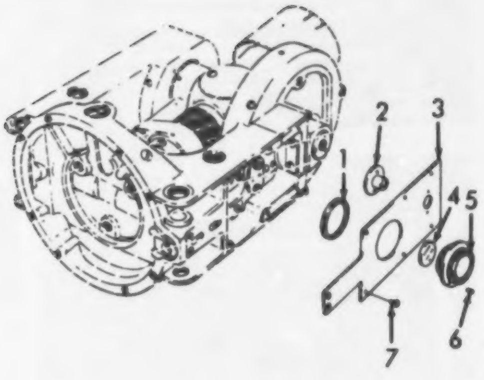
EMC 6675-232-15/56

1 Machine screw (spec) (4 rqr)
2 Plate
3 Right side prism
4 Metal prism
5 Level vial beam
6 Level vial

7 Screw (6 rqr)
8 Washer
9 Adjusting screw
10 Helical compression spring
11 Screw (2 rqr)
12 Window

13 Housing
14 Screw
15 Setscrew
16 Pin
17 Cover
18 Left side prism

Figure 56. Vertical collimation level assembly, disassembly and reassembly.



EMC 6675–232–15/57

1 Mount nut
2 Plug-in lamp bushing
3 Left-side support cover
4 Glass window
5 Illumination mirror mount
6 Setscrew
7 Screw

Figure 57. Left-side support cover assembly, disassembly and reassembly.

e. Reassembly. Refer to figure 59 and reassemble the collimation housing and collimation lever assemblies.

f. Installation.

(1) Refer to figure 58 and install the vertical collimation housing and vertical collimation lever as an assembly.

(2) Install the collimation slow-motion screw (par. 126).

(3) Install the vertical collimation level assembly (par. 122).

(4) Install the left-side support cover (par. 123).

(5) Install the collimation level mirror (par. 105).

125. Vertical Circle Assembly

a. General. The vertical circle assembly is located on the left side of the U-standard and is connected to the telescope axis to provide vertical readings for the operator.

b. Removal.

(1) Remove the vertical collimation housing (par. 124).

(2) Refer to figure 60 and remove the vertical circle assembly.

c. Disassembly. Refer to figure 61 and disassemble the vertical circle assembly.

d. Cleaning, Inspection, and Repair.

(1) Clean all metal parts with and approved cleaning solvent. Clean the vertical circle with a clean, soft cloth moistened with an approved cleaning solvent or use lens tissue. Clean all threaded surfaces with a brush moistened in an approved cleaning solvent.

(2) Inspect the circle for breaks, etchings, or other visible damage. Inspect the hardware for damaged threads.

(3) Straighten all bent or dented parts and smooth all rough surfaces. Replace all damaged or worn parts that cannot be repaired.

e. Reassembly. Refer to figure 61 and reassemble the vertical circle assembly.

f. Installation.

(1) Refer to figure 60 and install the vertical circle assembly.

(2) Install the vertical collimation housing (par. 124).

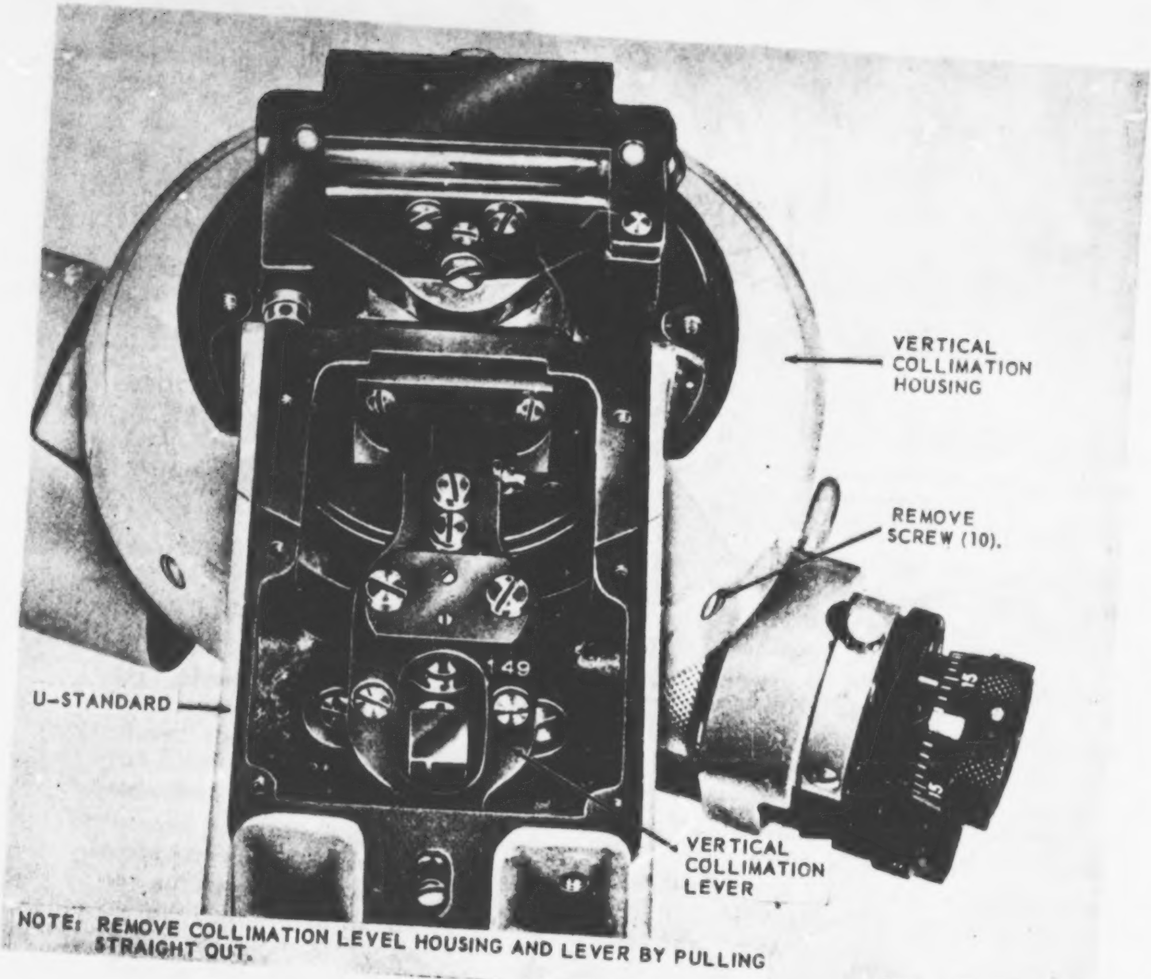
126. Collimation Slow-Motion Screw Assembly

a. General. The collimation slow-motion screw is used to determine an exact horizontal line of sight for the telescope. The screw is designed to travel slowly so that the operator can make precise adjustments.

b. Removal and Disassembly. Refer to figure 54 and remove and disassemble the collimation slow-motion screw assembly.

c. Cleaning, Inspection, and Repair.

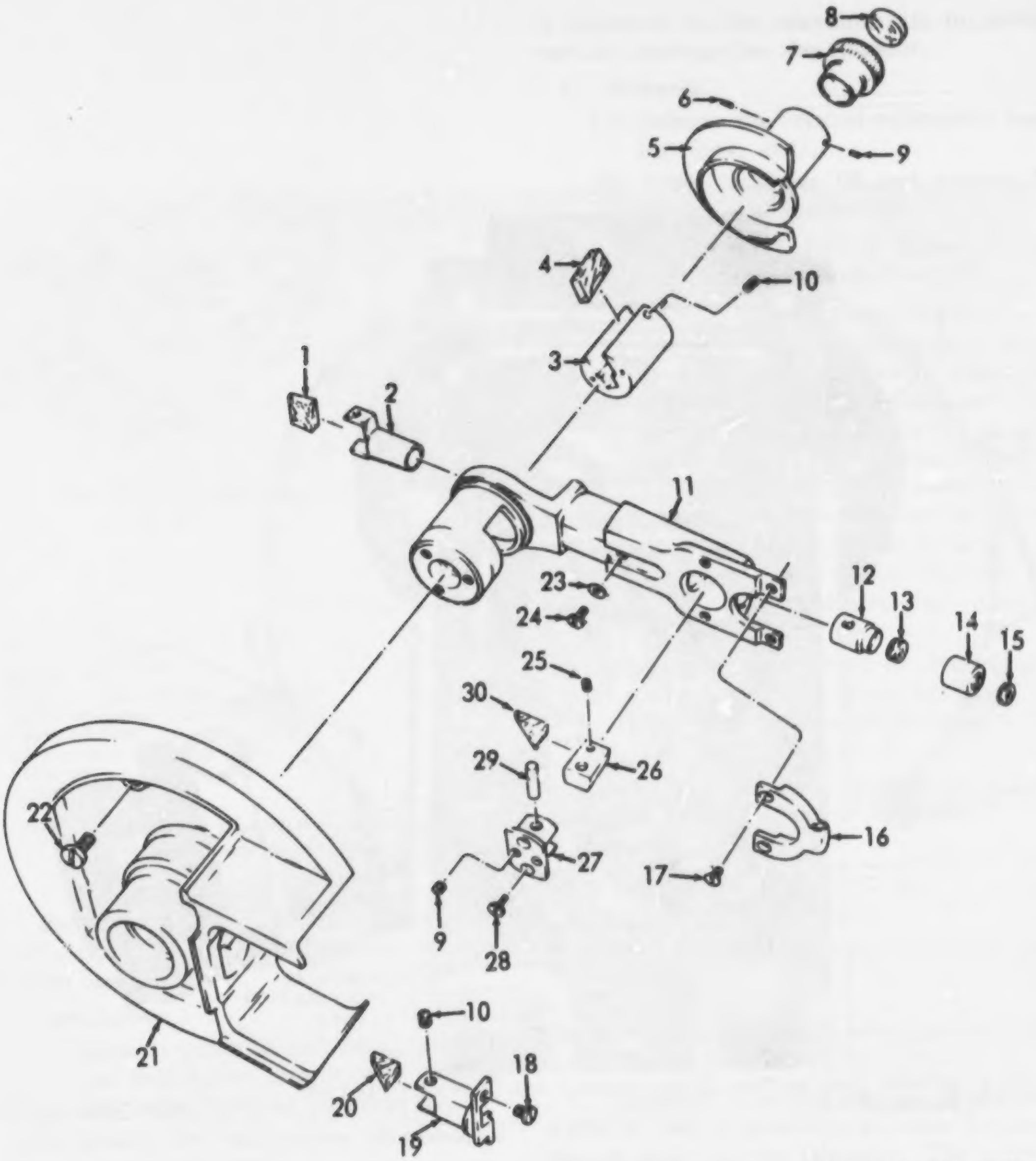
(1) Clean all parts with an approved cleaning solvent. Brush all threaded surfaces thoroughly with a small brush dipped in an approved cleaning


VERTICAL COLLIMATION HOUSING
REMOVE SCREW (10).
U-STANDARD
VERTICAL COLLIMATION LEVER
149
15
15

NOTE: REMOVE COLLIMATION LEVEL HOUSING AND LEVER BY PULLING STRAIGHT OUT.

EMC 6675-232-15/58

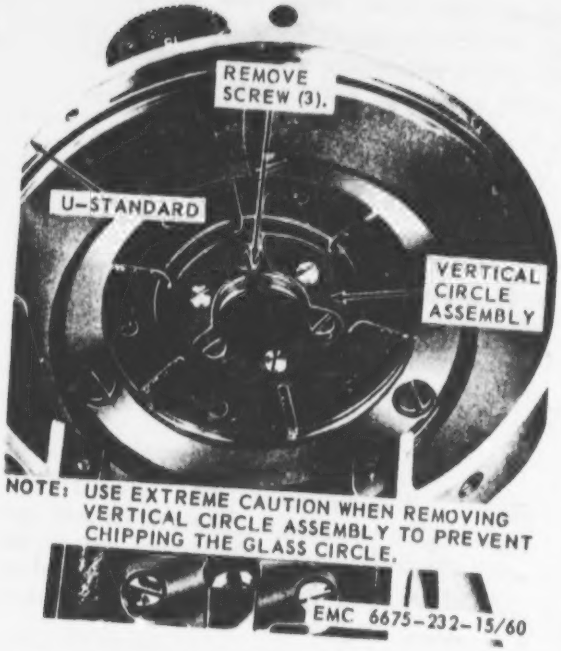
Figure 58. Vertical collimation housing and vertical collimation lever assemblies, removal and installation.


8
7
6
5
9
4
10
3
1
2
11
23
24
12
13
14
15
25
30
26
29
22
27
16
17
9
28
10
21
18
20
19

EMC 6675-232-15/59

1	Prism	11	Shell	21	Housing
2	Housing	12	Lens mount	22	Screw (3 rqr)
3	Housing	13	Lens	23	Lockwasher (2 rqr)
4	Prism	14	Lens mount	24	Machine screw (spec) (2 rqr)
5	Sleeve	15	Lens	25	Setscrew (2 rqr)
6	Setscrew (2 rqr)	16	Collimation lever	26	Mount
7	Mount	17	Screw (2 rqr)	27	Sleeve
8	Vernier lens	18	Machine screw (2 rqr)	28	Screw
9	Screw (3 rqr)	19	Housing	29	Pin
10	Setscrew (2 rqr)	20	Prism	30	Prism

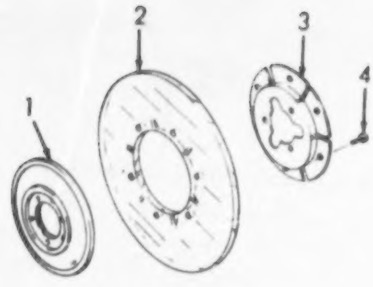
Figure 59. Vertical collimation housing and vertical collimation lever assemblies, disassembly and reassembly.



NOTE: USE EXTREME CAUTION WHEN REMOVING VERTICAL CIRCLE ASSEMBLY TO PREVENT CHIPPING THE GLASS CIRCLE.

EMC 6675-232-15/60

Figure 60. Vertical circle assembly, removal and installation.



EMC 6675-200-15/41

1 Sleeve	3 Spring disk
2 Vertical circle	4 Machine screw (3 rqr)

Figure 61. Vertical circle assembly, disassembly and reassembly.

solvent. Remove any grease or foreign matter from the housings with a cotton swab moistened with an approved cleaning solvent. Thoroughly clean the inside of the lead screw, stop nut, and bushing.

(2) Inspect all threaded surfaces for worn or damaged threads. Inspect the spring for wear, breaks, and fatigue. Inspect the pin and housings for burs, cracks, and bends. Inspect the adjusting screws and split nut for burs, wear, and damage.

(3) Remove all burs. Stretch the spring to provide better tension if it shows signs of fatigue. Replace all defective parts that cannot be repaired.

d. Reassembly and Installation. Refer to figure 54 and reassemble and install the collimation slow-motion screw assembly.

e. Adjustment. Refer to paragraph 17 and adjust the collimation slow-motion screw.

Section XIII. READING LENS, ILLUMINATION LENS, AND COMBINATION PRISM AND LENS ASSEMBLIES

127. Reading Lens Assemblies

a. General. The reading lens assemblies are located in the left side of the U-standard, below the collimation lever, and are used to magnify the readings of the horizontal circle obtained by the horizontal circle prism.

b. Removal and Disassembly.

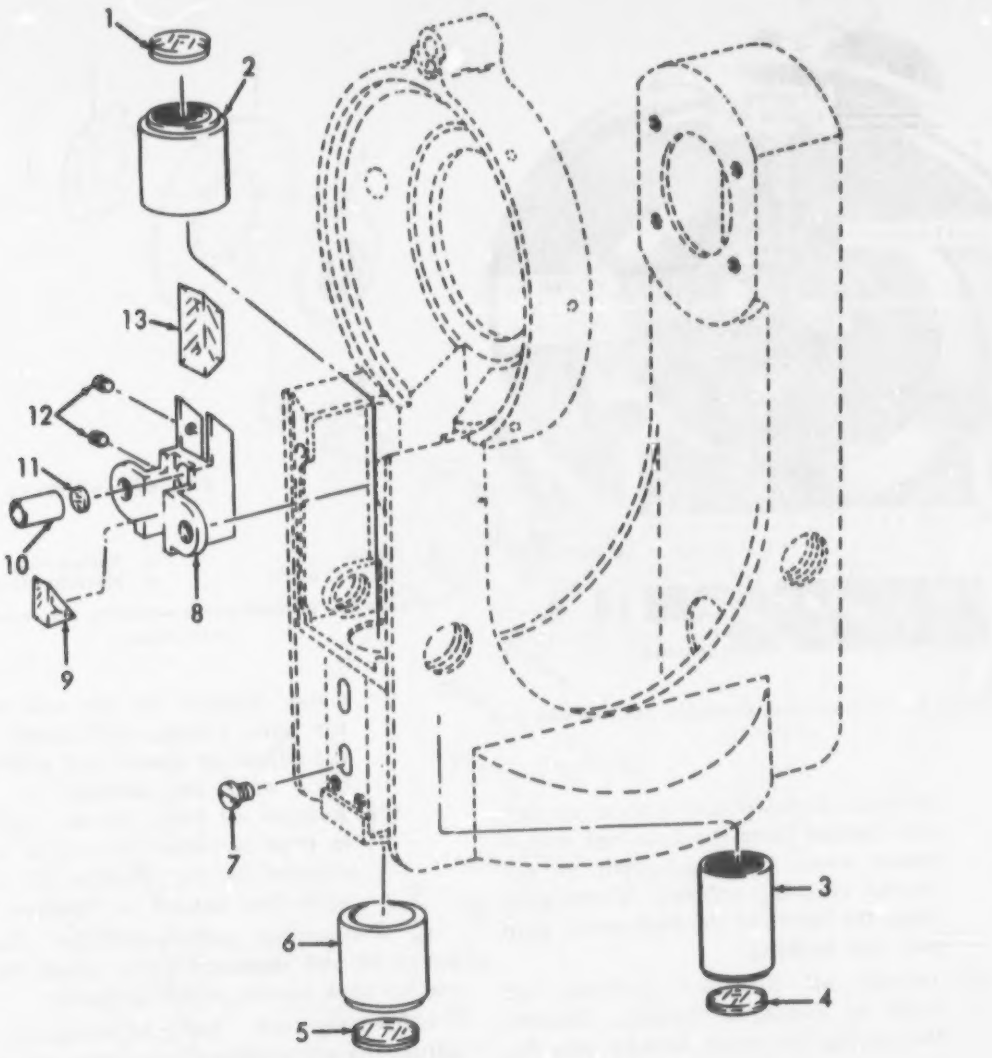
(1) Remove the horizontal circle prism assembly (par. 109).

(2) Remove the vertical collimation housing and vertical collimation lever assemblies (par. 124).

(3) Refer to figure 62 and remove and disassemble the reading lens assemblies.

c. Cleaning, Inspection, and Repair.

(1) Clean the lens mounts with an approved cleaning solvent. Clean and



EMC 6675-232-15/62

1 Upper reading lens
2 Lens mount
3 Lens mount
4 Illumination lens
5 Lower reading lens
6 Lens mount
7 Machine screw (2 rqr)
8 Prism and lens mount
9 Vertical circle illumination prism
10 Lens housing
11 Vertical circle illumination lens
12 Setscrew (2 rqr)
13 Vertical circle illumination prism

Figure 62. Reading lens, illumination lens, and combination prism and lens assemblies, removal, disassembly, reassembly, and installation.

polish the lenses with lens tissue dipped in grain alcohol or acetone.

(2) Inspect the lens mounts for cracks or breaks. Inspect the lenses for chips, breaks, and etching.

(3) Replace all defective parts.

d. Reassembly and Installation.

(1) Refer to figure 62 and reassemble and install the reading lens assemblies.

(2) Install the vertical collimation housing and vertical collimation lever assemblies (par. 124).

(3) Install the horizontal circle prism assembly (par. 109).

128. Illumination Lens Assembly

a. General. The illumination lens assembly, located above the horizontal circle assembly on the left side of the U-standard, illuminates the horizontal circle for reading purposes.

b. Removal.

(1) Remove the horizontal circle assembly (par. 113).

(2) Refer to figure 62 and remove the illumination lens assembly.

c. Cleaning, Inspection, and Repair.

(1) Clean the lens mount with an approved cleaning solvent. Clean and polish the lenses with lens tissue dipped in grain alcohol or acetone.

(2) Inspect the lens mount for cracks or breaks. Inspect the lens for chips, breaks, and etching.

(3) Replace all defective parts.

d. Installation.

(1) Refer to figure 62 and install the illumination lens assembly.

(2) Install the horizontal circle assembly (par. 113).

129. Combination Prism and Lens Assembly

a. General. The combination prisms and lens assembly consists of the horizontal circle illumination prism, vertical circle illumination prism, and vertical circle illumination lens assembly. It is located beneath the vertical circle on the left side of the U-standard.

b. Removal and Disassembly.

(1) Remove the vertical circle assembly (par. 125).

(2) Refer to figure 62 and remove and disassemble the combination prism and lens assembly.

c. Cleaning, Inspection, and Repair.

(1) Clean the prism mount and lens housing with an approved cleaning solvent. Clean and polish the prisms and lens with lens tissue dipped in grain alcohol or acetone.

(2) Inspect the prism mount and lens housing for cracks and breaks. Inspect the prisms and lens for chips, cracks, and etching.

(3) Replace all defective parts.

d. Reassembly and Installation.

(1) Refer to figure 62 and reassemble and install the combination prism and lens assembly.

(2) Install the vertical circle assembly (par. 125)

Section XIV. MICROSCOPE, TELESCOPE EYEPIECE AND RETICLE, TELESCOPE FOCUS AND OBJECTIVE, AND TELESCOPE LEVEL ASSEMBLIES

130. Microscope Assembly

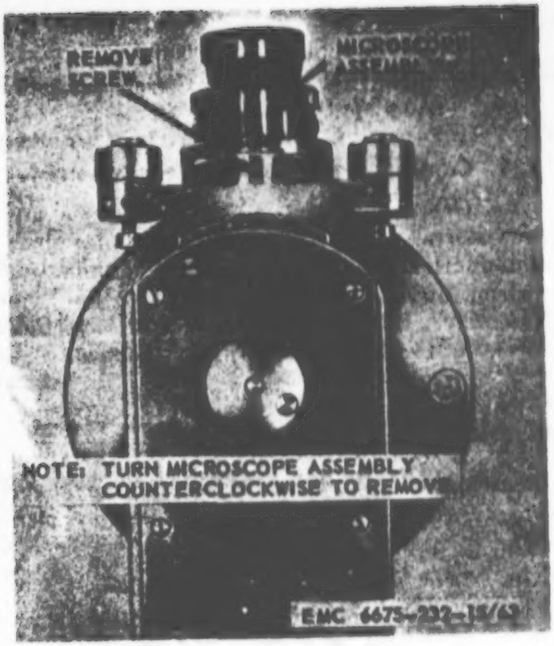
a. General. The microscope assembly is used to focus in and read the vertical and horizontal circle scales.

b. Removal. Refer to figure 63 and remove the microscope assembly.

c. Disassembly. Refer to figure 64 and disassemble the microscope.

d. Cleaning, Inspection, and Repair.

(1) Clean all metal parts with an approved cleaning solvent. Clean the lenses with grain alcohol or acetone and lens tissue.



NOTE: TURN MICROSCOPE ASSEMBLY COUNTERCLOCKWISE TO REMOVE

Figure 63. Microscope assembly, removal and installation.

(2) Inspect the tubes, housing, and washer for dents, and burs. Inspect the lenses for chips, cracks, scratches, and etchings. Remove any burs and straighten minor dents.

(3) Replace all defective parts that cannot be repaired. Paint all metal surfaces where the paint is scratched or worn off.

e. Reassembly. Refer to figure 64 and reassemble the microscope assembly.

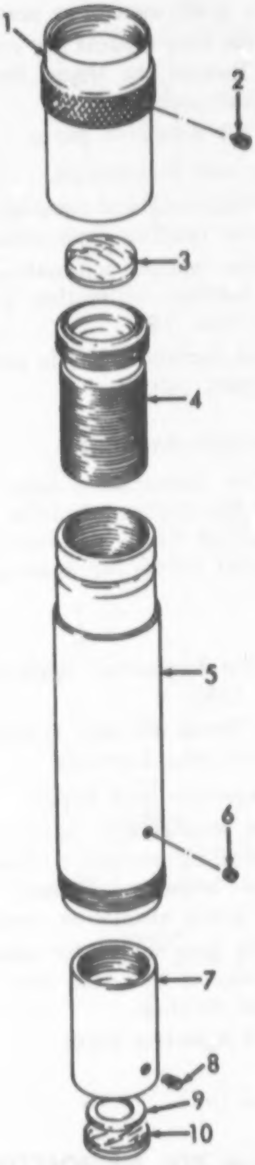
f. Installation. Refer to figure 63 and install the microscope assembly.

131. Telescope Eyepiece and Reticle Assemblies

a. General. The telescope eyepiece assembly is used to bring the lines of the reticle into focus and to focus in the objective point.

b. Removal.

(1) Remove the microscope assembly (par. 130).



1 Eyepiece lens tube
2 Setscrew
3 Lens
4 Housing
5 Microscope tube
6 Setscrew
7 Mount
8 Screw
9 Washer
10 Lens

Figure 64. Microscope assembly, disassembly and reassembly.

(2) Refer to figure 65 and remove the telescope eyepiece and reticle assemblies.

c. Disassembly. Refer to figure 66 and disassemble the telescope eyepiece and reticle assemblies.

d. Cleaning, Inspection, and Repair.

(1) Clean all metal parts with an approved cleaning solvent. Wipe the lenses clean with lens tissue moistened with grain alcohol or acetone.

(2) Brush all threaded parts with a small brush dipped in cleaning solvent. Dry all parts thoroughly with a clean soft cloth.

(3) Inspect all threaded surfaces for worn or damaged threads. Inspect the housings and bushings for dents, cracks, and breaks. Inspect the lenses for chips, scratches, and etching.

(4) Remove all burs. Straighten out minor dents and bends. Paint all metal surfaces where the paint is scratched or worn off. Replace all defective parts that cannot be repaired.

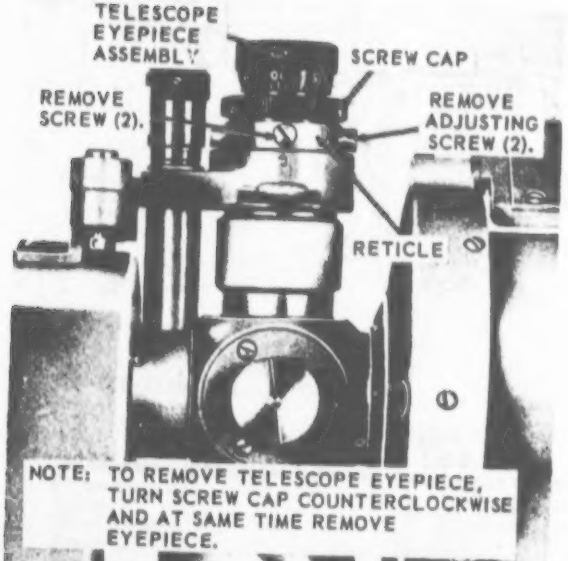

TELESCOPE EYEPIECE ASSEMBLY
SCREW CAP
REMOVE SCREW (2).
REMOVE ADJUSTING SCREW (2).
RETICLE
NOTE: TO REMOVE TELESCOPE EYEPIECE, TURN SCREW CAP COUNTERCLOCKWISE AND AT SAME TIME REMOVE EYEPIECE.
EMC 6675-232-15/65

Figure 65. Telescope eyepiece and reticle assemblies, removal and installation.

e. Reassembly. Refer to figure 66 and reassemble the telescope eyepiece and reticle assemblies.

f. Installation.

(1) Refer to figure 65 and install the telescope eyepiece and reticle assemblies.

(2) Install the microscope assembly (par. 130).

g. Adjustment. Refer to paragraph 17 and adjust the reticle to compensate for horizontal collimation error.

132. Telescope Focus and Objective Assemblies

a. General. The objective end of the telescope collects and concentrates a larger beam of light than is possible with the naked eye; the objective lens assemblies also magnify the sighted object. The telescope focus assembly contatins the necessary controls and lens to bring the sighted object into sharp focus for the operator.

b. Removal and Disassembly.

(1) Remove the telescope eyepiece and reticle assemblies (par. 131)

(2) Remove the telescope level assembly (par. 65).

(3) Refer to figure 66 and remove and disassemble the telescope focus and objective assemblies.

c. Cleaning, Inspection, and Repair.

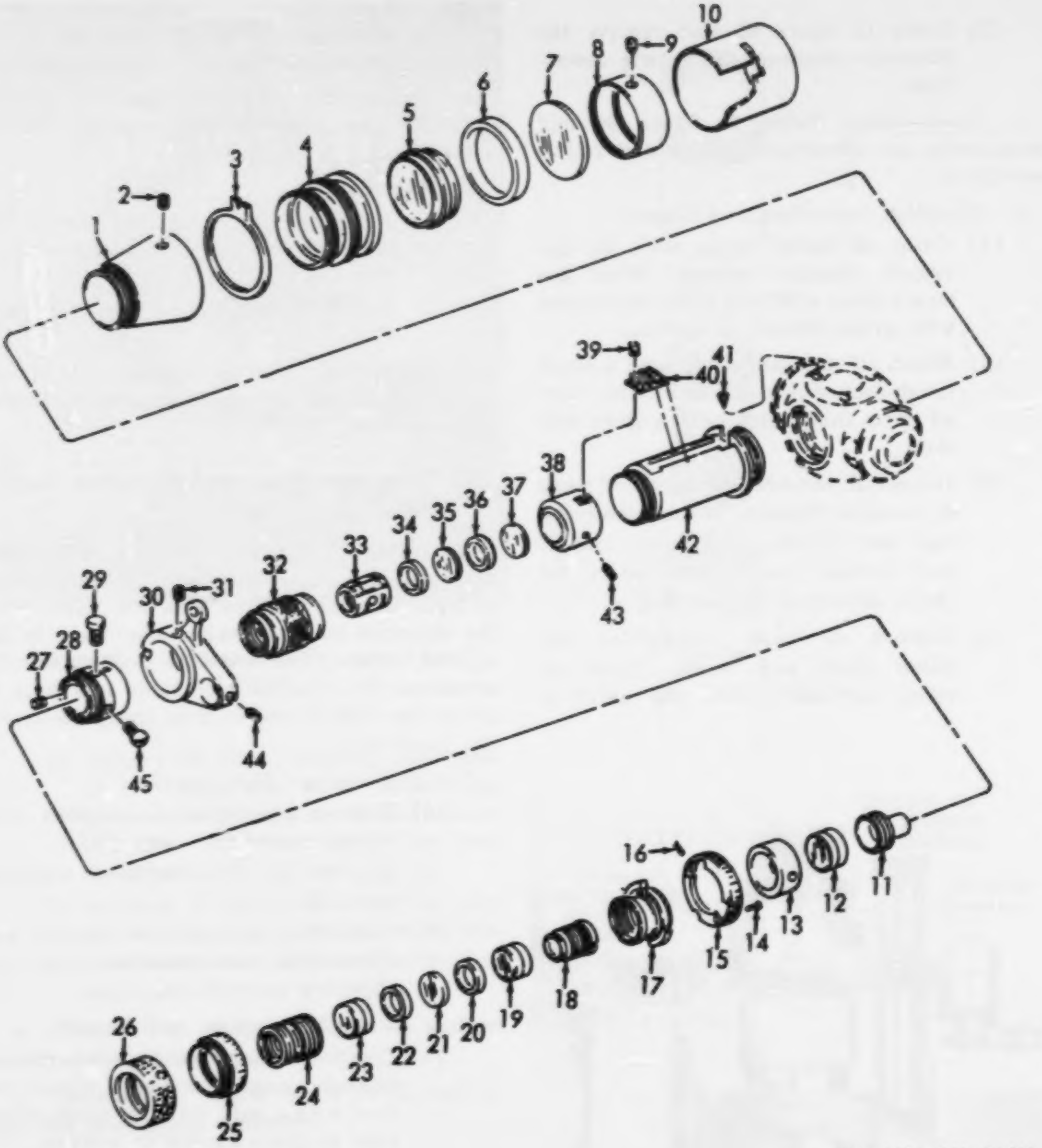
(1) Clean all metal parts with an approved cleaning solvent. Clean the lens with a soft, lint-free cloth moistened in grain alcohol or acetone.

(2) Inspect the lens for scratches, chips, cracks, and etching. Inspect the focusing tubes, lens mount, and housings for burs, cracks, breaks, and worn or damaged threads.

(3) Remove all burs and minor dents. Replace all defective parts that cannot be repaired.

d. Reassembly and Installation.

(1) Refer to figure 66 and reassemble and


10
9
8
7
6
5
4
3
2
1
39
41
40
38
37
36
35
34
33
32
31
30
29
28
27
42
43
44
45
16
11
12
13
14
15
17
18
19
20
21
22
23
24
25
26

EMC 6675-232-15/66

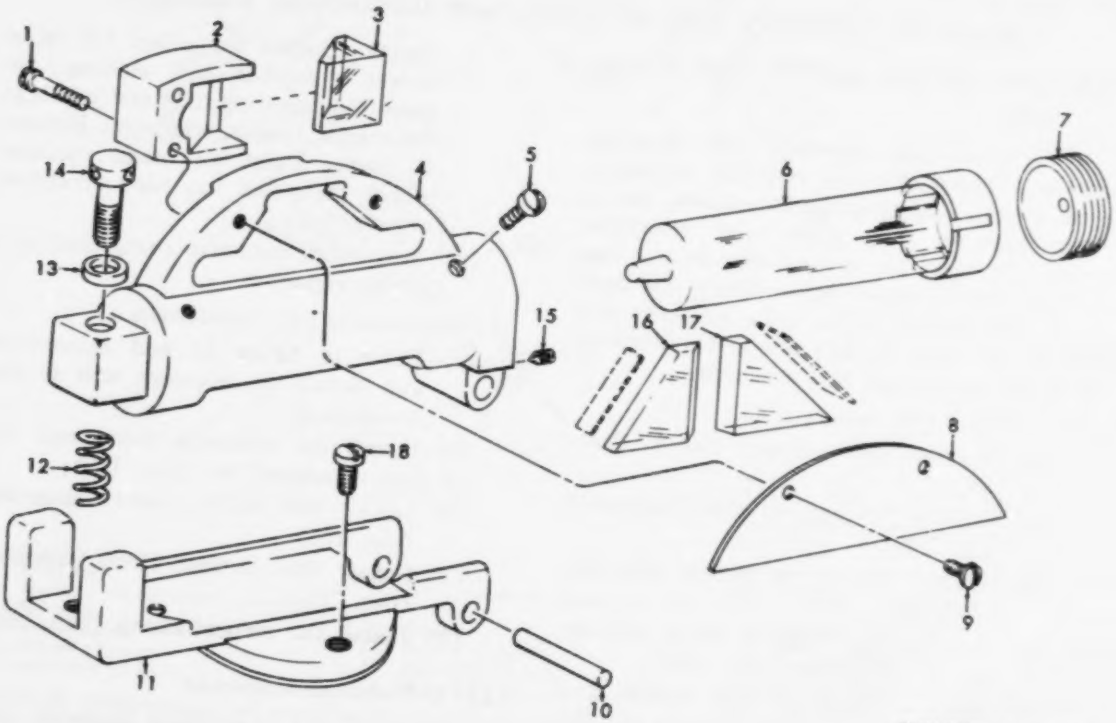
Figure 66. Telescope focus, objective, reticle, and eyepiece assemblies, removal, disassembly, reassembly, and installation.

1 Tube
2 Screw
3 Gun sight
4 Lens housing
5 Lens
6 Washer
7 Lens
8 Lockring
9 Setscrew
10 Sunshade
11 Housing
12 Reticle
13 Sleeve
14 Setscrew (2 rqr)
15 Screw cap

16 Setscrew
17 Threaded bushing
18 Lens housing
19 Lens
20 Washer
21 Lens
22 Washer
23 Lens
24 Eyepiece lens bushing
25 Index ring
26 Focusing knob
27 Screw
28 Sleeve
29 Screw (2 rqr)
30 Bridge

31 Screw (3 rqr)
32 Focusing tube
33 Tube
34 Washer
35 Lens
36 Washer
37 Lens
38 Inner focusing tube
39 Screw
40 Focusing segment
41 Machine screw (2 rqr)
42 Telescope lens housing
43 Setscrew
44 Setscrew
45 Setscrew

Figure 66—Continued.



EMC 6675–232–15/67

1 Machine screw (2 rqr)
2 Prism housing
3 Prism
4 Level housing
5 Screw
6 Vial level

7 Cover
8 Cover
9 Machine screw (2 rqr)
10 Pin
11 Level base
12 Spring

13 Washer
14 Vial adjusting screw
15 Screw
16 Prism
17 Prism
18 Screw (2 rqr)

Figure 67. Telescope level assembly, disassembly and reassembly.

best copy available

install the telescope focus and objective assemblies.

(2) Install the telescope level assembly (par. 65).

(3) Install the telescope eyepiece and reticle assemblies (par. 131).

133. Telescope Level Assembly

a. Removal. Refer to paragraph 65 and remove the telescope assembly.

b. Disassembly. Refer to figure 67 and disassemble the telescope level assembly.

c. Cleaning, Inspection, and Repair.

(1) Clean all metal parts with an approved cleaning solvent. Clean the prisms with a soft cloth moistened in grain alcohol.

(2) Inspect the metal parts for burred edges and dents. Remove burs and minor dents. Inspect all threaded parts for worn or damaged threads. Inspect the prism for cracks, scratches, and etching.

(3) Replace all defective parts that cannot be repaired.

d. Reassembly. Refer to figure 67 and reassemble the telescope level assembly.

e. Installation. Refer to paragraph 65 and install the telescope level assembly.

Section XV. TELESCOPE AXIS, 90° PRISM, AND U-STANDARD ASSEMBLIES

134. Telescope Axis and 90° Prism Assemblies

a. General. The telescope axis assembly acts as a mount for the telescope objective, focus, reticle, and eyepiece assemblies, microscope assembly, 90° prism, and associated parts. It is supported in the U-standard by two axis bearings. The 90° prism directs the horizontal and vertical circle scale readings and illumination from the left side of the U-standard to the microscope lens assembly.

b. Removal and Disassembly.

(1) Remove the vertical clamp (par. 120).

(2) Remove the vertical circle assembly (par. 125).

(3) Remove the reticle mirror assembly (par. 107).

(4) Remove the telescope focus and objective assemblies (par. 132).

(5) Refer to figure 68 and remove and disassemble the telescope axis and 90° prism assemblies.

c. Cleaning, Inspection, and Repair.

(1) Clean all metal parts in an approved cleaning solvent. Clean and polish the prism with lens tissue dipped in grain alcohol or acetone.

(2) Inspect the prism sleeve, prism mount, and frame for dents and breaks. Inspect the prism for chips, breaks, scratches, and etching. Inspect the telescope axis and bearings for cracks, breaks, and burs. Remove all burs. Paint all metal surfaces where the paint has been scratched or worn off.

(3) Replace all defective parts that cannot be repaired.

d. Reassembly and Installation.

(1) Refer to figure 68 and reassemble and install the telescope axis in the U-standard.

(2) Install the telescope focus and objective assemblies (par. 132).

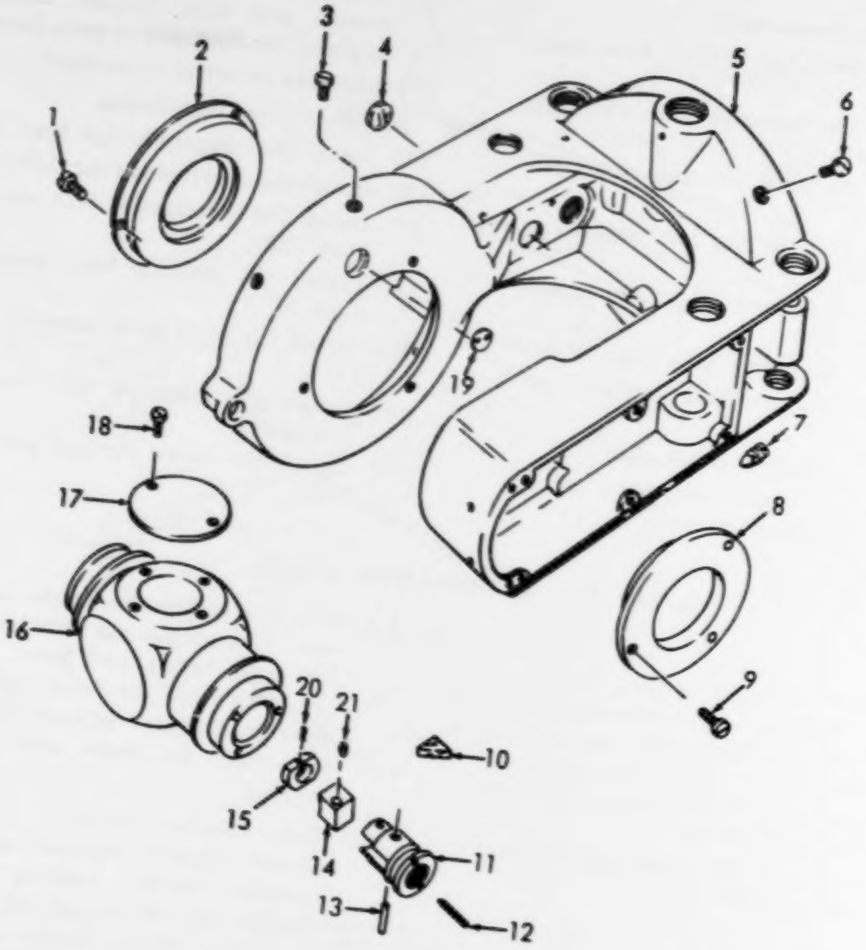
(3) Install the reticle mirror assembly (par. 107).

(4) Install the vertical circle assembly (par. 125).

(5) Install the vertical clamp (par. 120).

135. U-Standard Assembly

a. General. The U-standard assembly consists of the U-standard, right and left side support covers, horizontal circle reading and illumination lens assemblies, plate level illumination window, and associated hardware. The U-standard assembly also forms a supporting and housing structure for the telescope and vertical circle assemblies and associated controls.



EMC 6675-232-15/68

1 Machine screw (spec) (3 rqr)
2 Bearing
3 Machine screw (spec) (2 rqr)
4 Window
5 U-standard
6 Screw (2 rqr)
7 Setscrew (2 rqr)

8 Bearing
9 Machine screw (spec) (3 rqr)
10 Prism
11 Sleeve
12 Screw (2 rqr)
13 Setscrew (3 rqr)
14 Mount

15 Frame
16 Telescope axis
17 Cover
18 Screw (2 rqr)
19 Access cover
20 Screw (2 rqr)
21 Pin

Figure 68. Telescope axis, 90° prism, and U-standard assemblies, removal, disassembly, reassembly, and installation.

b. Removal and Disassembly.

(1) Remove the inner vertical axis (par. 116).

(2) Remove the telescope axis assembly (par. 134).

(3) Remove the plate level assembly (par. 117).

(4) Remove the reading lens assemblies (par. 127).

(5) Remove the illumination lens assembly (par. 128).

(6) Remove the clamp pins (par. 118).

(7) Remove the compass bridge (par. 141).

c. Cleaning, Inspection, and Repair.

(1) Clean the U-standard with an approved cleaning solvent.

(2) Inspect the U-standard for cracks, breaks, and burs. Inspect threaded surfaces for damaged or worn threads.

(3) Replace a defective U-standard.

d. Reassembly and Installation.

(1) Install the compass bridge (par. 141).

(2) Install the clamp pins (par. 118).

(3) Install the illumination lens assembly (par. 128).

(4) Install the reading lens assemblies (par. 127).

(5) Install the plate level assembly (par. 117).

(6) Install the telescope axis assembly (par. 134).

(7) Install the inner vertical axis (par. 116).

Section XVI. ILLUMINATION SYSTEM

136. General

The illumination system is used to permit night reading of plate and collimation levels and to illuminate the horizontal and vertical circles. The hand light is used to illuminate the circular level and to provide general illumination for nighttime operations.

Caution: **Do not use the hand light in close proximity to the compass.**

137. Battery Box

a. Disassembly. Refer to figure 69 and disassemble the battery box.

b. Cleaning, Inspection, and Repair.

(1) Clean all metal parts with an approved cleaning solvent. Remove all corrosion from terminals and contacts. Wipe dirt and foreign matter from cables, trunk, rheostat, springs, and washers. Clean the battery box with a soft cloth moistened with an approved cleaning solvent and dry thoroughly.

(2) Inspect the cables for damaged insulation, broken wires, and defective terminals. Inspect the springs for bends, breaks, and fatigue. Inspect the trunk for splits, cracks, and other damage. Inspect the rheostat for improper operation and damage. Inspect the sockets for cracks and damage. Inspect the contacts and lever for burs, bends, and wear. Inspect the battery box for dents, cracks, and defective clamps. Inspect the screws and pins for burs and damaged threads.

(3) Tape cracked insulation on cables. Stretch slightly fatigued springs to provide better holding tension. Smooth out all burred surfaces and straighten minor bends. Paint all metal surfaces where the paint has been scratched or worn off. Replace all parts that cannot be repaired.

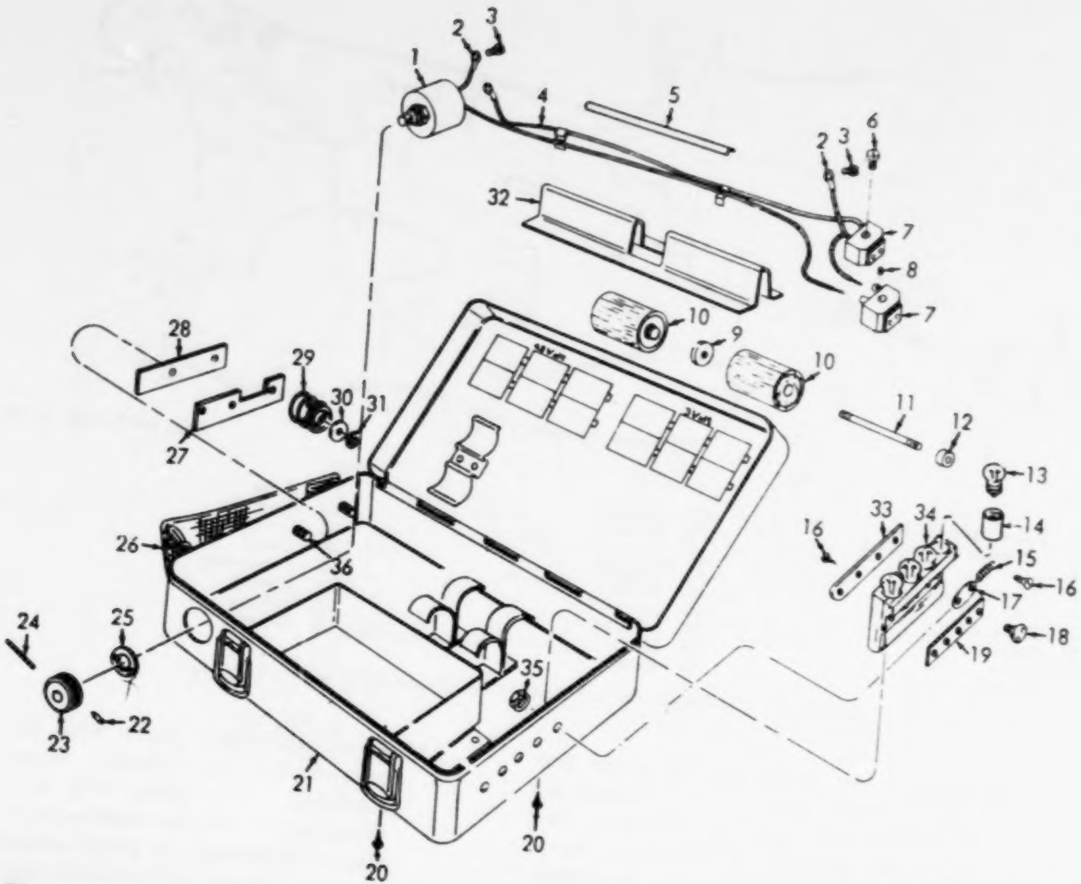
c. Reassembly. Refer to figure 69 and reassemble the battery box.

138. Hand Light and Cable Assembly

a. Disassembly. Refer to figure 70 and disassemble the hand light and cable assembly.

b. Cleaning, Inspection, and Repair.

(1) Clean all metal parts with an approved cleaning solvent. Wipe the cable clean with a soft cloth. Clean the corrosion from the terminals and contacts. Brush all threaded surfaces free of dirt and foreign material.

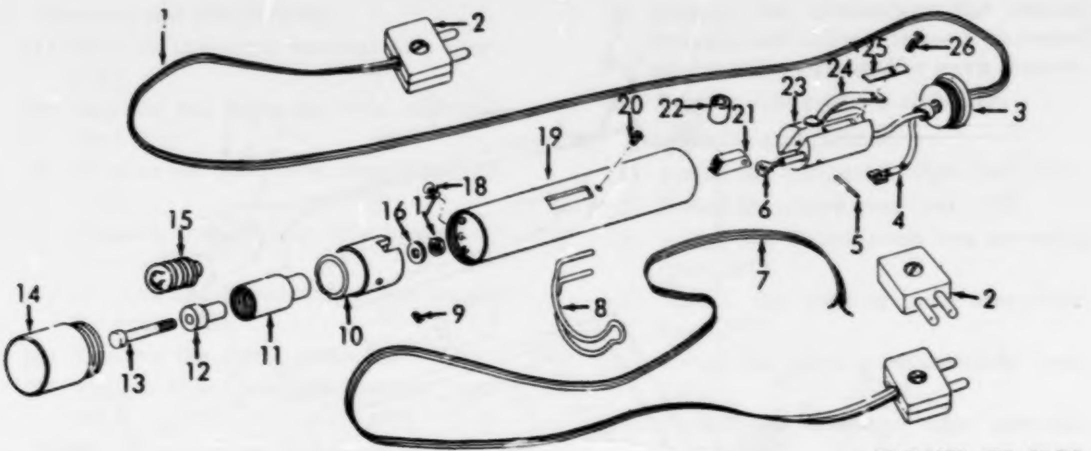


3
2
1
4
5
2
3
6
32
7
8
7
10
9
10
28
29
30
31
27
11
12
13
33
34
14
16
15
16
17
18
19
26
36
24
25
35
23
22
21
20
20

EMC 6675-232-15/69

1 Rheostat
2 Terminal (2 rqr)
3 Screw (2 rqr)
4 Electrical cable
5 Insulation
6 Screw (2 rqr)
7 Socket (2 rqr)
8 Screw (4 rqr)
9 Washer (2 rqr)
10 Battery body (2 rqr)
11 Axle (2 rqr)
12 Nut (2 rqr)
13 Lamp (4 rqr)
14 Housing (4 rqr)
15 Spring
16 Screw (4 rqr)
17 Contact
18 Knob
19 Lever
20 Screw (4 rqr)
21 Box
22 Setscrew
23 Knob
24 Pin
25 Washer (2 rqr)
26 Carrying strap
27 Electrical contact
28 Insulation
29 Spring (2 rqr)
30 Washer (2 rqr)
31 Nut (2 rqr)
32 Insulation
33 Contact
34 Trunk
35 Nut
36 Rivet (2 rqr)

Figure 69. Battery box, disassembly and reassembly.



EMC 6675-232-15/70

1	**Hand light cable**	10	**Adapter**	19	**Tube**
2	**Connector (3 rqr)**	11	**Housing**	20	**Screw**
3	**Cap**	12	**Tube**	21	**Lever**
4	**Sleeve**	13	**Contact**	22	**Tube**
5	**Pin**	14	**Tube**	23	**Insulation**
6	**Terminal lug**	15	**Lamp**	24	**Spring**
7	**Cable**	16	**Insulation**	25	**Spring**
8	**Lever**	17	**Nut**	26	**Screw**
9	**Screw (2 rqr)**	18	**Screw**		

Figure 70. Hand light and cable assembly, disassembly and reassembly.

(2) Inspect the tubes and housings for dents, cracks, and breaks. Inspect all insulation for wear and damage. Inspect all contacts for corrosive damage and breaks. Inspect the terminals for burs, bends, and breaks. Inspect the levers for bends and damage.

(3) Repair with tape minor insulation damage to the cable. Straighten out all dents and bends. Remove all burs. Replace all defective parts that cannot be repaired.

c. Reassembly. Refer to figure 70 and reassemble the hand light and cable assembly.

139. Electrical Illumination Assembly

a. Disassembly. Refer to figure 71 and disassemble the electrical illumination assembly.

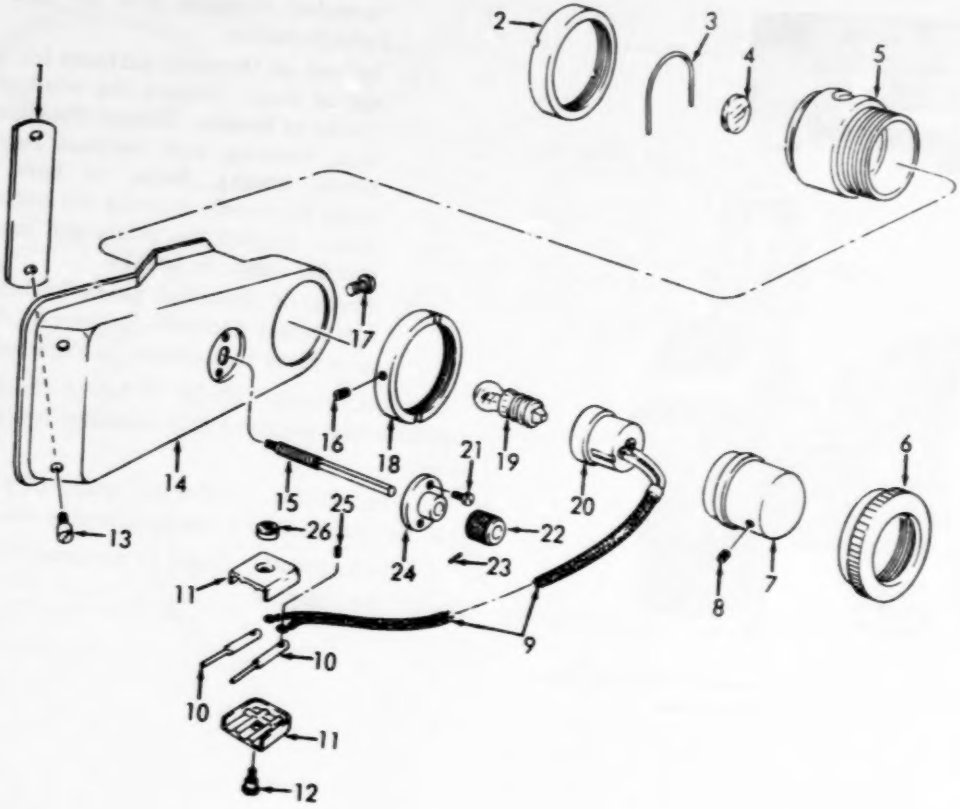
b. Cleaning, Inspection, and Repair.

(1) Clean all metal parts with an approved cleaning solvent. Wipe the electrical cable clean with a cloth. Clean and polish the window with lens tissue moistened in grain alcohol or acetone. Brush all threaded surfaces free of dirt and foreign material. Clean any corrosion from the connector contact pins.

(2) Inspect the lens for cracks or chips. Inspect the lampholder, light cover, and knob for cracks, breaks, and dents. Inspect the electrical cable insulation for wear or deterioration.

(3) Smooth out minor dents. Repair minor insulation damage to the cable with tape. Replace all defective parts that cannot be repaired.

c. Reassembly. Refer to figure 71 and reassemble the electrical illumination assembly.



EMC 6675-232-15/71

1	Mirror
2	Threaded bushing
3	Retaining clip
4	Lens
5	Bushing
6	Nut
7	Lampholder
8	Pin
9	Cable
10	Connector contact pin (2 rqr)
11	Connector shell (2 rqr)
12	Screw (spec)
13	Screw (spec) (2 rqr)
14	Cover
15	Bolt
16	Setscrew
17	Machine screw
18	Lockring
19	Lamp
20	Insulation bushing
21	Machine screw (spec) (2 rqr)
22	Knob
23	Pin
24	Sleeve
25	Setscrew (2 rqr)
26	Nut

Figure 71. Electrical illumination assembly, disassembly and reassembly.

Section XVII. COMPASS AND COMPASS BRIDGE ASSEMBLY

140. General

The compass is provided with the theodolite to enable the operator to rapidly orient the target with magnetic north.

141. Compass and Compass Bridge Assembly

a. Removal. Refer to figure 72 and remove the compass and compass bridge assembly.

b. Disassembly. Refer to figure 73 and disassemble the compass and compas bridge assembly.

c. Cleaning, Inspection, and Repair.

(1) Clean all metal parts with an approved cleaning solvent. Clean and polish the prism and lens with lens tissue moistened in grain alcohol or acetone. Clean the window with an

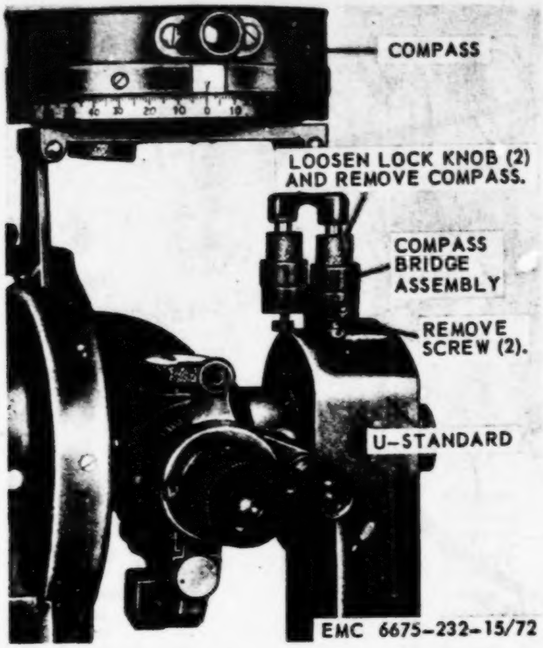

COMPASS
LOOSEN LOCK KNOB (2) AND REMOVE COMPASS.
COMPASS BRIDGE ASSEMBLY
REMOVE SCREW (2).
U-STANDARD
EMC 6675-232-15/72

Figure 72. Compass and compass bridge assembly, removal and installation.

approved glass cleaner. Brush all threaded surfaces free of dirt and foreign matter.

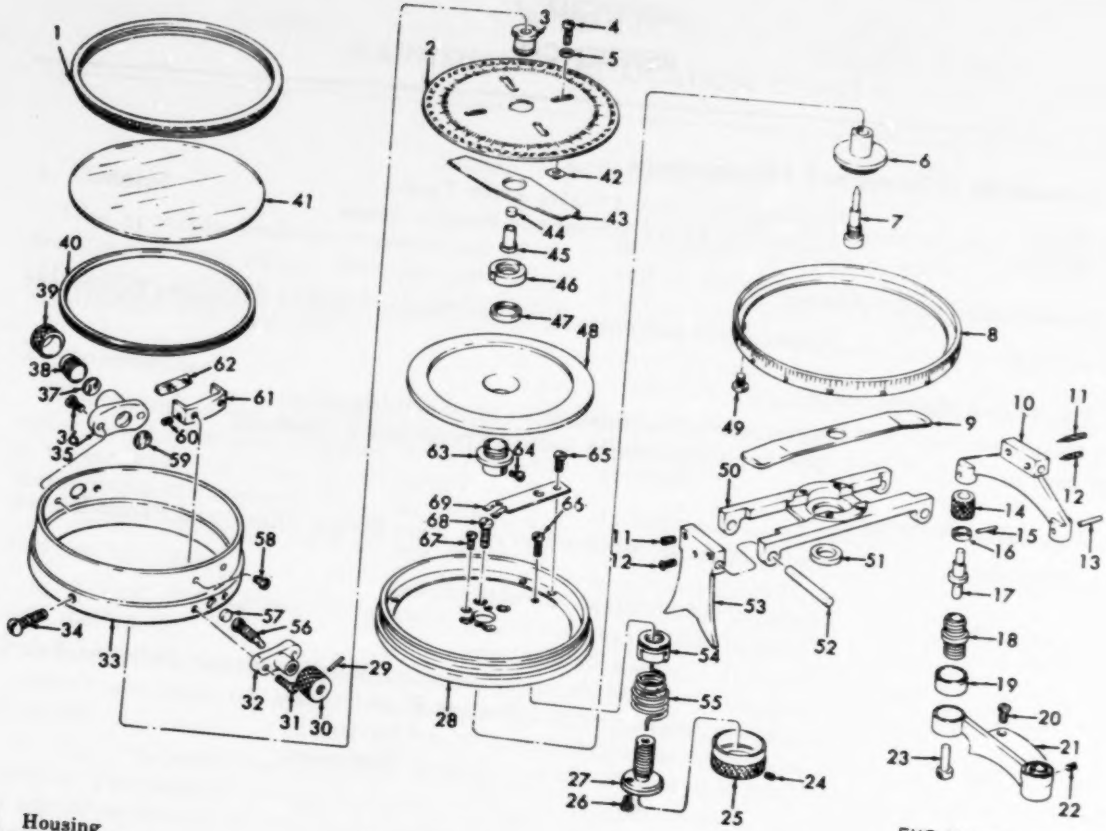
(2) Inspect all threaded surfaces for damage or wear. Inspect the window for cracks or breaks. Inspect the compass base, housing, and compass legs for bends, breaks, dents, or burs. Inspect the needle bearing for excessive wear. Inspect the prism and lens for cracks, chips, or breaks.

(3) Chase all threaded parts having minor thread damage. Replace all defective parts that cannot be repaired.

d. Reassembly. Refer to figure 73 and reassemble the compass and compass bridge assembly.

e. Installation. Refer to figure 72 and install the compass and compass bridge assembly.

f. Adjustment. Refer to paragraph 17 and adjust the compass.


1
3
4
5
2
6
42
41
43
7
44
45
40
46
39
47
48
8
38
62
37
61
49
9
36
60
10
11
35
59
63
64
65
50
12
69
66
14
15
68
67
11
16
13
58
12
51
17
53
57
34
56
52
18
54
33
29
19
55
20
32
31
30
28
21
23
27
24
26
25
22
EMC 6675-232-15/73

1 Housing
2 Degree circle
3 Sleeve
4 Screw (4 rqr)
5 Washer (4 rqr)
6 Sleeve
7 Needle screw
8 Index ring
9 Spring
10 Compass leg
11 Setscrew (4 rqr)
12 Screw (2 rqr)
13 Pin (2 rqr)
14 Lock knob
15 Pin (2 rqr)
16 Stop ring (2 rqr)
17 Compass leg pin (2 rqr)
18 Leg pin sleeve (2 rqr)
19 Leg pin cover (2 rqr)
20 Screw (2 rqr)
21 Bridge
22 Screw (2 rqr)
23 Adjusting screw (2 rqr)

24 Screw
25 Caging knob
26 Machine screw (spec)
27 Screw pin
28 Compass base
29 Pin
30 Lock knob
31 Machine screw (spec) (2 rqr)
32 Sleeve
33 Compass housing
34 Screw (3 rqr)
35 Eyepiece bridge
36 Machine screw (spec) (2 rqr)
37 Eyepiece lens
38 Housing
39 Knob
40 Lockring
41 Window
42 Balance weight (4 rqr)
43 Compass needle
44 Needle bearing
45 Bearing housing
46 Lockring

47 Locknut
48 Damping disk
49 Machine screw (spec) (3 rqr)
50 Sleeve
51 Nut
52 Pin (2 rqr)
53 Compass leg
54 Bushing
55 Spring
56 Pin (spec)
57 Washer
58 Machine screw (2 rqr)
59 Lens
60 Screw
61 Prism housing
62 Prism
63 Sleeve
64 Machine screw (spec)
65 Screw (spec)
66 Screw (spec)
67 Machine screw (spec) (3 rqr)
68 Machine screw (spec) (4 rqr)
69 Circle lifter spring

Figure 73. Compass and compass bridge assembly, disassembly and reassembly.

APPENDIX I

REFERENCES

1. Dictionaries of Terms and Abbreviations

AR 320–5	Dictionary of United States Army Terms.
AR 320–50	Authorized Abbreviations and Brevity Codes.

2. Preservation and Painting

TB ENG 60	Preservation and Painting of Serviceable Corps of Engineers Equipment.

3. Preventive Maintenance

AR 750–5	Maintenance Responsibilities and Shop Operation.
TM 38–750	The Army Equipment Record System and Procedures.

4. Pubication Indexes

DA Pam 108–1	Index of Army Motion Pictures, Film Strips, Slides, and Phono-Recordings.
DA Pam 310–1	Index of Administrative Publications.
DA Pam 310–2	Index of Blank Forms.
DA Pam 310–3	Index of Training Publications.
DA Pam 310–4	Index of Technical Manuals, Technical Bulletins, Supply Bulletins, Lubrication Orders, and Modification Work Orders.
DA Pam 310–5	Index of Graphic Training Aids and Devices.
DA Pam 310–25	Index of Supply Manuals—Corps of Engineers.

5. Shipment and Limited Storage

AR 743–505	Limited Storage of Engineer Mechanical Equipment.
TM 38–230	Preservation, Packaging, and Packing of Military Supplies and Equipment.

6. Supply Publications

SM 10–C9100–SL	Petroleum, Petroleum-Base Products, and Related Materiel.
TM 5–6675–232–25P	Organizational, Field, and Depot Maintenance Repair Parts and Special Tool Lists, Theodolite: Directional; 1 Min. Graduation; 5.9 in. Long Telescope w/Accessories (Wild Heerbrugg Model T–16 Type I). FSN 6675–828–6397.

7. Training Aids

FM 21–5	Military Training.
FM 21–6	Technique of Military Instruction.
FM 21–30	Military Symbols.

APPENDIX II

MAINTENANCE ALLOCATION CHART

Section I. INTRODUCTION

1. General

This appendix contains explanations of all maintenance and repair functions authorized the various echelons. Section II contains the maintenance allocation chart.

2. Maintenance

Maintenance is any action taken to keep materiel in a serviceable condition or to restore it to serviceability when it is unserviceable. Maintenance of materiel includes the following:

a. Service. To clean, preserve, and replenish fuel and lubricants.

b. Adjust. To regulate periodically to prevent malfunction.

c. Inspect. To verify serviceability and detect incipient electrical or mechanical failure by scrutiny.

d. Test. To verify serviceability and detect incipient electrical or mechanical failure by use of special equipment such as gages, meters, and the like.

e. Replace. To substitute serviceable assemblies, subassemblies, and parts for unserviceable components.

f. Repair. To restore an item to serviceable condition through correction of a specific failure or unserviceable condition. This function includes, but is not limited to, inspecting, cleaning, preserving, adjusting, replacing, welding, riveting, and straightening.

g. Aline. To adjust two or more components of an electrical system so that their functions are properly synchronized.

h. Calibrate. To determine, check, or rectify the graduation of an instrument, weapon, or weapons system, or components of a weapons system.

i. Overhaul. To restore an item to completely serviceable condition as prescribed by serviceability standards developed and published by heads of technical services. This is accomplished through employment of the technique of "Inspect and Repair Only as Necessary" (IROAN). Maximum utilization of diagnostic and test equipment is combined with minimum disassembly of the item during the overhaul process.

3. Explanation of Columns

a. Functional Group. The functional group is a numerical group set up on a functional basis. The applicable functional grouping indexes (obtained from the Corps of Engineers Functional Grouping Indexes) are listed on the MAC in the appropriate numerical sequence. These indexes normally are set up in accordance with their function and proximity to each other.

b. Components and Related Operation. This column contains the functional grouping index heading, subgroup headings, and a brief description of the part starting with the noun name. It also designates the operations to be performed such as service, adjust, inspect, test, replace, repair, and overhaul.

c. Echelon of Maintenance. This column contains the various echelons of maintenance by number designation. An X placed in the appropriate echelon column in line with an indicated maintenance function authorizes that echelon to perform the function. The X indicates the lowest echelon responsible for performing the function, but does not necessarily indicate repair parts stockage at that level. Higher echelons are authorized to perform the indicated functions of lower echelons.

d. Remarks. This column lists specific maintenance functions, special tools, cross-references, instructions, and the like pertinent to the operation being performed.

Section II. MAINTENANCE ALLOCATION CHART

Functional group	Components and related operation	Echelons of maintenance					Remarks
		1	2	3	4	5	
17	BODY; CAB; HOOD; HULL.						
1708	Carrying Cases.						
	Base assembly:						
	Replace	X					
	Repair		X				
	Hood assembly:						
	Replace	X					
	Repair		X				
	Field, pack, canvas:						
	Replace	X					
	Repair		X				
	Case, shipping:						
	Repair		X				
26	ACCESSORIES, PUBLICATIONS, TEST EQUIPMENT AND TOOLS.						
2602	Accessories.						
	Case, accessory:						
	Replace	X					
	Repair		X				
	Plumb bob:						
	Replace	X					
	Repair	X					
	Cover, instrument:						
	Replace	X					
2604	Special Tools.						
	Wrench, Tripod:						
	Replace	X					
67	PRECISION INSTRUMENTS, MECHANICAL OR ELECTRICAL.						
6700	Theodolite.						
	Theodolite:						
	Service	X					External.
	Adjust	X					
	Replace		X				
	Repair			X			
	Overhaul					X	
6701	Telescope Assembly.						
	Axis, telescope:						
	Replace					X	
	Repair					X	
	Tube, telescope:						
	Replace					X	
	Washer, sight:						
	Replace					X	
	Bearing, telescope axis:						
	Replace					X	
6702	Optics.						
	Objective assembly, telescope:						
	Service	X					External.
	Replace					X	
	Repair					X	
	Focusing assembly, telescope:						
	Replace					X	
	Repair					X	

Functional group	Components and related operation	1	2	3	4	5	Remarks
6702	Optics—Continued						
	Lens assembly, focusing:						
	Replace					X	
	Reticle assembly, telescope:						
	Replace					X	
	Eyepiece assembly, telescope:						
	Service	X					External.
	Replace		X				
	Repair					X	
	Microscope assembly:						
	Service	X					
	Replace					X	
	Repair					X	
	Lens assembly, microscope:						
	Replace					X	
	Repair					X	
	Eyepiece assembly, microscope:						
	Service	X					External.
	Replace					X	
	Repair					X	
	Mirror assembly, illumination:						
	Service	X					
	Replace	X					
	Repair			X			
	Mirror, telescope illumination:						
	Adjust	X					External.
	Replace					X	
	Repair					X	
	Prisms, internal:						
	Replace					X	
	Optical plumb device:						
	Replace					X	
	Repair					X	
	Eyepiece assembly, optical plumb:						
	Service	X					External.
	Replace					X	
	Repair					X	
	Eyepiece assembly, compass:						
	Service	X					External.
	Replace			X			
	Mirror, level:						
	Replace					X	
	Repair					X	
	Mirror collimation level:						
	Adjust	X					External.
	Replace					X	
	Repair					X	
	Sunshade, telescope:						
	Replace	X					
	Circle, horizontal:						
	Replace					X	
	Circle assembly, vertical:						
	Replace					X	
6703	Mechanical, Structural, and Precision Parts.						
	Vertical clamp assembly:						
	Replace					X	
	Repair					X	

Functional group	Components and related operation	Echelons of maintenance 1	2	3	4	5	Remarks
6703	Mechanical, Structural, and Precision Parts—Continued						
	Tribrach assembly:						
	Replace		X				
	Repair					X	
	Plate assembly, starshaped:						
	Replace					X	
	Repair					X	
	U-standard assembly:						
	Replace					X	
	Repair					X	
	Screw, leveling:						
	Adjust	X					External.
	Replace			X			
	Repair			X			
	Housing assembly, inner base:						
	Replace					X	
	Repair					X	
	Clamp, horizontal:						
	Replace					X	
	Repair					X	
	Clamp assembly, circle:						
	Replace					X	
	Repair					X	
	Screw assembly, slow motion, horizontal, vertical, and collimation:						
	Adjust	X					External.
	Replace			X			
	Repair				X		
	Housing assembly, horizontal circle:						
	Replace					X	
	Repair					X	
6708	Batteries.						
	Battery, dry:						
	Replace	X					
6709	Lamps.						
	Illumination assembly, electrical:						
	Service	X					
	Replace	X					
	Repair			X			
	Lamp, battery box (bulb):						
	Replace	X					
	Light, hand:						
	Service	X					
	Replace	X					
	Repair			X			
6718	Mounted Connecting Devices.						
	Plug, illumination light:						
	Replace					X	
	Ring, contact segments:						
	Replace					X	
6719	Miscellaneous Wiring and Fittings.						
	Cable, electrical (internal):						
	Replace					X	

Functional group	Components and related operation	Echelons of maintenance					Remarks
		1	2	3	4	5	
6723	Power Supply.						
	Battery box assembly:						
	Service	X					
	Replace	X					
	Repair			X			
	Cable, electrical:						
	Replace	X					
	Repair		X				
6724	Compass and Levels.						
	Compass assembly, directional:						
	Service	X					
	Replace	X					
	Repair				X		
	Bridge assembly, compass:						
	Adjust	X					External.
	Replace				X		
	Lock, compass:						
	Replace					X	
	Level assembly, circular:						
	Adjust	X					External.
	Replace			X			
	Repair				X		
	Level, plate:						
	Adjust	X					External.
	Replace					X	
	Repair					X	
	Level assembly, vertical collimation:						
	Adjust	X					External.
	Replace					X	
	Repair					X	
	Level, telescope:						
	Adjust	X					
	Replace		X				
	Repair					X	
6725	Tripods.						
	Tripod, surveying:						
	Service	X					
	Replace		X				
	Repair		X				
	Head assembly, tripod:						
	Replace		X				
	Repair		X				
	Leg assembly, tripod:						
	Replace	X					
	Repair	X					
	Clamp assembly, leg:						
	Replace		X				
	Repair		X				
82	MINERALS AND CHEMICALS.						
	Container, ground plate:						
	Service		X				
	Replace		X				

APPENDIX III

BASIC ISSUE ITEMS

Section I. INTRODUCTION

1. General

Section II lists the accessories, tools, and publications required in 1st echelon maintenance and operation, initially issued with, or authorized for the Wild Heerbrugg Model T–16 Type I Theodolite.

2. Explanation of Columns Contained in Section II

a. Source Codes. The information provided in each column is as follows:

(1) *Technical service.* This column lists the basic number (or symbol) of the technical service assigned supply responsibility for the part. Blank spaces denote Corps of Engineers supply responsibility. General Engineer supply parts are identified by the letters "GE" in parentheses, following the nomenclature in the description column. Other technical services basic numbers (or symbols) are—

10—Quartermaster Corps
11—Signal Corps
12—Adjutant General's Corps

(2) *Source.* The selection status and source of supply for each part are indicated by one of the following code symbols:

(*a*) P—applied to high-mortality repair parts which are stocked in or supplied from the technical service depot system, and authorized for use at indicated maintenance echelons.

(*b*) P1—applied to repair parts which are low-mortality parts, stocked in or supplied from technical service depots, and authorized for installation at indicated maintenance echelons.

(*c*) M—applied to repair parts which are not procured or stocked but are to be manufactured at indicated maintenance echelons.

(*d*) X2—applied to repair parts which are not stocked. The indicated maintenance echelon requiring such repair parts will attempt to obtain them through cannnibalization; if not obtainable through cannibalization, such repair parts will be requisitioned with supporting justification through normal supply channels.

(3) *Maintenance.* The lowest maintenance echelon authorized to use, stock, install, or manufacture the part is indicated by the following code symbol:

O—Organizational Maintenance (1st and 2d Echelon)

(4) *Recoverability.* Repair parts and/or tool and equipment items that are recoverable are indicated by one of the following code symbols:

(*a*) R—applied to repair parts and assemblies which are economically repairable at field maintenance facilities (3d and 4th echelons) and normally are furnished by supply on an exchange basis.

(*b*) T—applied to high-dollar value recoverable repair parts which are subject to special handling and are issued on an exchange basis. Such repair parts normally are repaired or overhauled at depot maintenance facilities.

(*c*) U—applied to repair parts specifically selected for salvage by reclamation units because of precious metal content, critical materials, high-dollar value reusable casings, castings, and the like.

Note. When no code is shown in the recoverability column the part is considered expendable.

b. Federal Stock Numbers. The Federal stock number will be shown in this column, and will be used for requisitioning purposes.

c. Description.

(1) The item name and a brief description of the part are shown.

(2) A five-digit Federal supply code for manufacturers and/or other technical services is shown in parentheses, followed by the manufacturer's part number. This number will be used for requisitioning purposes when no Federal stock number is indicated in the Federal stock number column.

Example: (08645) 86453

(3) The letters "GE", shown in parentheses immediately following the description, indicate General Engineer supply responsibility for the part.

d. Unit of Issue. If no abbreviation is shown in this column, the unit of issue is each.

e. Quantity Authorized. This column lists the quantities of repair parts, accessories, tools, or publications authorized for issue to the equipment operator or crew as required.

f. Quantity Issued with Equipment. This column lists the quantities of repair parts, accessories, tools, or publications that are initially issued with each item of equipment. Those indicated by an asterisk are to be requisitioned through normal supply channels as required.

g. Illustrations. This column is subdivided into two columns which provide the following information:

(1) *Figure number.* Provides the identifying number of the illustration.

(2) *Item number.* Provides the referenced number for the parts shown in the illustration.

3. Federal Supply Code for Manufacturers

89905—Wild Heerbrugg Instruments Inc.

4. Comments and Suggestions

Suggestions and recommendations for changes to the basic issue items list will be submitted on DA Form 2028 to the Commanding Officer, U. S. Army Mobility Support Center, ATTN: SMOMS-MS, P. O. Box 119, Columbus 16, Ohio. Direct communication is authorized.

Section II. BASIC ISSUE ITEMS LIST

Source codes				Federal stock No.	Description	Unit of issue	Expendability	Quantity authorized	Quantity issued with equipment	Illustration	
Technical service	Source	Maintenance	Recoverability							Fig	Item
					GROUP 17—HOOD 1708 Carrying Cases						
	P	O	-----	6675-353-4123	FIELD PACK, CANVAS (89905) XT2-29	-----	-----	1	1		
					GROUP 26—ACCESSORIES, PUBLICATIONS, AND TOOLS 2602 Accessories						
	P	O	-----	6675-560-5472	CASE, ACCESSORY (89905) T16-761	-----	-----	1	1		
	P	O	-----	6675-378-9401	COVER, INSTRUMENT (89905) NT2-549	-----	-----	1	1		
10	P	O	-----	7920-378-9524	BRUSH, DUSTING (89905) 3A-59	-----	-----	1	1		

Section II. BASIC ISSUE ITEMS LIST—Continued

Source codes				Federal stock No.	Description	Unit of issue	Expendability	Quantity authorized	Quantity issued with equipment	Illustration	
Technical service	Source	Maintenance	Recoverability							Fig	Item
					2602 Accessories—Continued						
	P	O	-----	6675-446-1762	CONTAINER, GREASE (89905) HDF3-4	-----	-----	1	1		
	M	O	-----	-----	CHAMOIS (89905) HDP3-7 MANUFACTURE FROM:	-----	-----	1	1		
10	P	O	-----	8330-257-2498	CHAMOIS, LEATHER: suede finish, 0.0234 to 0.0469 in. thk (7½ x 7½ in. required).	-----	-----	1	1		
	P	O	-----	6675-560-5463	CONTAINER, NEEDLE (89905) T16-812	-----	-----	1	1		
	P	O	-----	5210-353-4130	PLUMB BOB SOCKET ASSEMBLY (89905) XT2-35A	-----	-----	1	1		
	X2	-----	-----	-----	PLUMB BOB ASSEMBLY (89905) 12B-272-28	-----	-----	1	1		
	X2	O	-----	-----	SLIDE, ADJUSTER (89905) 3A-39A	-----	-----	1	1		
	M	O	-----	-----	STRING (89905) 3A-40 MANUFACTURE FROM:						
10	P	O	-----	4020-270-1659	CORD, LINEN: 1/20 in. dia, 25 yd block.						
	X2	O	-----	-----	RING (89905) 3A-56	-----	-----	1	1		
	X2	O	-----	-----	BAYONET SOCKET (89905) 3A-548	-----	-----	1	1		
					2604 Special Tools						
	P1	O	-----	6675-353-4103	PIN, ADJUSTING (89905) 3A-55	-----	-----	2	2		
	P1	O	-----	5120-429-2948	SCREWDRIVER, SM (89905) HDW1-5	-----	-----	1	1		
	P1	O	-----	5120-446-2860	SCREWDRIVER, IGE (89905) HDW1-10	-----	-----	1	1		
10	P	O	-----	5120-378-9520	WRENCH, TRIPOD (89905) 3A-29	-----	-----	1	1		
					2605 Publications						
12	-----	-----	-----	-----	Department of the Army Operator, Organizational, Field, and Depot Maintenance Manual: TM 5-6675-232-15.	-----	-----	2	2		
12	-----	-----	-----	-----	Department of the Army Organizational, Field and Depot Maintenance Repair Parts and Special Tool Lists: TM 5-6675-232-25P	-----	-----	2	2		

Section II. BASIC ISSUE ITEMS LIST—Continued

Source codes				Federal stock No.	Description	Unit of issue	Expendability	Quantity authorized	Quantity issued with equipment	Illustration	
Technical service	Source	Maintenance	Recoverability							Fig	Item
					2605 Publications—Continued GROUP 67—PRECISION INSTRUMENTS 6702—Optics						
	P	O	----	6675-624-3686	SUNSHADE (89905) XT2-92		–	1	1		
	P	O	– –	6675-560-5586	EYEPIECE PRISM ASSEMBLY, TELESCOPE (89905) XT16-115A		–	1	1		
	P	O		6675-560-5587	EYEPIECE PRISM ASSEMBLY, MICROSCOPE (89905) XT16-117		–	1	1		
	P	O	-- --	6675-446-1768	SUNGLASS ASSEMBLY (89905) XT16-116A		–	1	1		
					6709 Lamps						
	P	O	-- --	6675-560-5649	ELECTRICAL ILLUMINATION ASSEMBLY (89905) XT16-113		–	1	1		
	P	O		6675-378-9501	LIGHT, HAND (89905) XT2-73		--	1	1		
	P	O	---	6675-859-5936	LAMP, INCANDESCENT (89905) HEG3-64	--	----	4	4		
					6719 Miscellaneous Wiring and Fittings						
	P	O	----	6150-378-9500	CABLE, ELECTRICAL (89905) X72-72	---	----	1	1		
					6723 Power Supply						
	P	O	----	6675-378-9502	BATTERY BOX ASSEMBLY (89905) EB-319B	--	---	1	1		
					6708 Index, Batteries						
	P	O	----	6135-120-1020	BATTERY, DRY, 1.5V (89905) EB-329	--	----	4	*		
	X2	F	-----		BATTERY, DUMMY ASSEMBLY (89905) EB-323	-----	-----	2	2		
					6724 Compass						
	P	O	-----	6675-560-5644	COMPASS ASSEMBLY, CIRCULAR, DEGREE (89905) XT16-118A-DEG	-----	-----	1	1		
	P	O	-----	5305-786-5222	SCREW, INSTRUMENT NEEDLE (89905) T16-595P	-----	-----	2	2		

INDEX

	Paragraph	Page
Adjustments:		
Circular level	17*b*	27
Collimation level	17*j*	30
Collimation slow-motion screw	17*e*	28
Compass	17*h*	29
General	17*a*	27
Horizontal collimation	17*i*	29
Horizontal slow-motion screw	17*g*	30
Optical plumb	17*d*	27
Plate level	17*c*	27
Vertical slow-motion screw	17*f*	28
Axes:		
Inner vertical	116	71
Outer vertical	113	67
Telescope (assembly)	134	90
Base, inner	111	67
Basic issue tools and equipment	26	33
Battery box	137	92
Battery replacement	34	40
Box, battery	137	92
Bridge assembly, compass	140, 141	95
Cable assembly, hand light	138	92
Canvas field pack	56	44
Carrying case and canvas field pack:		
Canvas field pack	56	44
Carrying case	55	42
General	54	42
Case, carrying	55	42
Circle and micrometer images will not focus.	53	42
Circle assemblies:		
Horizontal	113	67
Vertical	125	80
Circle housing assembly, horizontal	111	67
Circular level:		
Adjustment	17*b*	27
Bubble does not stay in center	44, 90	41, 58
Clamp, vertical	120	75
Clamp assemblies:		
Horizontal	112	67
Horizontal circle	108	63
Clamp pins	118	75
Cold weather operation	19	32
Collimation housing assembly, vertical	124	78
Collimation level assembly, vertical	122	77
Level adjustment	17*j*	30
Collimation level bubble does not stay in center.	45, 91	41, 58
Collimation level cover and collimation level mirror, illumination mirror, and reticle mirror assemblies:		
Collimation level cover and collimation level mirror.	105	61
General	104	61
Illumination mirror assembly	106	61
Reticle mirror assembly	107	63
Collimation level mirror	105	61
Collimation lever assembly, vertical	124	78
Collimation slow-motion screw assembly.	126	80
Screw adjustment	17*e*	28
Combination prism and lens assembly	129	85
Compass and compass bridge assembly	140, 141	95
Compass adjustment	17*h*	29
Compass assembly will not seat properly:		
On compass bridge	87	58
On theodolite mounting	39	40
Compass circle:		
Will not balance	84	58
Will not rotate freely	36, 84	40, 58
Compass housing will not rotate on compass base.	37, 85	40, 58
Compass reference mark not clearly visible.	38, 86	40, 58
Compass reference mark out of focus	86	58
Components, separately packed	9	21
Controls and instruments	14, 15	23
Conversion, equipment	11	22
Covers:		
Collimation level	105	61
Left-side support (assembly)	123	78
Right-side support	119	75
Daily services, operator's	31	35
Data. (*See* Tabulated data.)		
Demolition:		
General	69	50
To render the theodolite inoperative.	70	50
Training	71	50
Description	3, 78	3, 53
Difference in models	5	8
Dimensions and weights	4*b*	3
Dismantling for movement	12	22
Dusty area operation	21	32
Electrical illumination assembly	139	94
Equipment	25	33
Basic issue tools	26	33

Paragraph Page

- Equipment—Continued
  - Dismantling for movement 12 22
  - Conversion 11 22
  - Inspecting 8 9
  - Inspection and maintenance in storage. 75 52
  - Installation of separately packed components. 9 21
  - Installation or setting-up instructions. 10 22
  - Loading for shipment 73 51
  - Maintenance in storage 75 52
  - Operation of equipment:
    - Adjustments 17 27
    - General 16 26
    - In dusty areas 21 32
    - In extreme cold (below 0° F.) 19 32
    - In extreme heat 20 32
    - In salt-water areas 23 32
    - In sandy areas 21 32
    - Theodolite operation 18 30
    - Under humid conditions 22 32
    - Under rainy conditions 22 32
  - Preparation for shipment 72 51
  - Preparation for storage 74 51
  - Special tools 24, 80 33, 56
- Equipment conversion 11 22
- Eyepiece assemblies:
  - Optical plumb device 115 71
  - Telescope 131 86
- Eyepiece prisms and sunglass 59 45
- Eyepieces:
  - General 57 44
  - Microscope 58 44
  - Telescope 58, 131 44, 86

- Field and depot maintenance repair parts. 81 56
- Field of vision not clear 93 59
- Field pack, canvas 56 44
- Focus and objective assemblies, telescope. 132 87
- Forms, record and report 2, 77 3, 53

- Hand light and cable assembly 138 92
- Horizontal circle:
  - Assembly 113 67
  - Clamp and horizontal prism assemblies. 108, 109 63
  - Graduations not at right angles to line dividing the two images. 96 59
  - Hard to move 49, 98 41, 59
  - Housing and inner base 111 67
- Horizontal slow-motion screw assembly 110 66
  - Screw adjustment 17*g* 30
- Hot weather operation 20 32
- Housing assemblies:
  - Collimation 124 78
  - Horizontal circle 111 67
- Humid conditions operation 22 32
- Identification and data 4 3
- Illumination assembly, electrical 139 94

Paragraph Page

- Illumination lens assembly 128 85
- Illumination mirror assembly 62, 63, 106 46, 61
- Illumination system:
  - Battery box 137 92
  - Electrical illumination assembly 139 94
  - Fails to function 48 41
  - Faulty 48, 97 41, 59
  - General 136 92
  - Hand light and cable assembly 138 92
- Inner base 111 67
- Inner vertical axis assembly 116 71
- Inspecting and servicing equipment 8 9
- Inspection and maintenance of equipment in storage. 75 52
- Installation of separately packed components. 9 21
- Installation or setting-up instructions 10 22
- Instrument will not stay on line 43 41
- Instruments and controls 14, 15 23

- Lamp replacement 33 40
- Left-side support cover assembly 123 78
- Lens assemblies:
  - Combination prism 129 85
  - Illumination 128 85
- Level adjustment, circular 17*b* 27
- Level assemblies:
  - Vertical collimation 122 77
  - Plate 117 73
  - Telescope 64, 65, 133 47, 90
- Level cover, collimation 105 61
- Leveling screws hard to turn or have excessive play. 99 59
- Level mirror collimation 105 61
- Light, hand 138 92
- Light on horizontal circle unequal or absent. 47, 95 41, 59
- Light on vertical circle unequal or absent. 47, 94 41, 59
- Lubrication 28, 29 33

- Maintenance:
  - Operator's. (*See* Operator's maintenance.)
  - Organizational 32 35
  - Quarterly preventive 32 35
  - Repair parts:
    - Field and depot 81 56
  - Organizational 27 33
  - Service. (*See* Preventive maintenance services.)
  - Storage 75 52
- Microscope assembly 130 85
- Microscope eyepiece 58 44
- Mirror assemblies:
  - Illumination 62, 63, 106 46, 61
  - Reticle 107 63
- Models, difference 5 8
- Movement to a new worksite:
  - Dismantling 12 22
  - Reinstallation 13 23
- 90° prism assembly 134 90

	Paragraph	Page
Objective and focus assemblies, telescope.	132	87
Operation of equipment:		
Adjustments	17	27
General	16	26
In dusty or sandy areas	21	32
In extreme cold (below 0° F.)	19	32
In extreme heat	20	32
In salt water areas	23	32
Theodolite	18	30
Under rainy or humid conditions	22	32
Operator's daily services	31	35
Operator's maintenance:		
Battery replacement	34	40
Lamp replacement	33	40
Optical plumb device	114	71
Optical plumb device eyepiece assembly.	115	71
Plumb device adjustment	17*d*	27
Organizational maintenance	32	35
Organizational maintenance repair parts.	27	33
Outer vertical axis	113	67
Pack, canvas field	56	44
Parts. (*See* Repair parts.)		
Pins, clamp	118	75
Plate level:		
Adjustment	17*c*	27
Assembly	117	73
Horizontal collimation adjustment	17*i*	29
Bubble does not stay in center	46, 92	41, 59
Plumb bob assembly	67	47
Plumb device. (*See* Optical plumb device.)		
Preparation of equipment:		
For shipment	72	51
For storage	74	51
Preventive maintenance services:		
General	30	35
Operator's daily services (*see also* Operator's maintenance.)	31	35
Quarterly organizational maintenance.	32	35
Prism and lens assembly, combination	129	85
Prism assembly, horizontal circle	109	63
Prisms, eyepiece	59	45
Quarterly preventive maintenance services.	32	35
Rainy conditions operation	22	32
Reading lens assemblies	127	83
Record and report forms	2, 77	3, 53
Reference mark not visible	38, 86	40, 58
Reference mark out of focus	86	58
Reinstallation after movement	13	23
Repair parts:		
Field and depot maintenance	81	56
Organizational	27	33
Report forms	2, 77	3, 53

	Paragraph	Page
Reticle and eyepiece assemblies, telescope.	131	86
Reticle mirror assembly	107	63
Right-side support cover	119	75
Salt water area operation	23	32
Sandy area operation	21	32
Scope	1, 76	3, 76
Screw assemblies:		
Collimation slow-motion	126	80
Horizontal slow-motion	110	66
Vertical clamp	119	75
Servicing equipment	8	9
Services. (*See* Preventive maintenance services.)		
Setting-up instructions	10	22
Shipment:		
Loading equipment	73	51
Preparation of equipment	72	51
Side support covers:		
Left (assembly)	123	78
Right	119	75
Slow-motion screw, vertical	121	77
Adjustment	17*f*	28
Slow-motion screw assemblies:		
Collimation	126	80
Screw adjustment	17*e*	28
Horizontal	110	66
Screw adjustment	17*g*	29
Special tools and equipment	24, 80	33, 56
Specially designed tools	82	56
Standards, time	79*b*	53
Storage:		
Inspection of equipment	75	52
Maintenance of equipment	75	52
Preparation of equipment	74	51
Sunglass	59	45
Support covers:		
Left-side (assembly)	123	78
Right-side	119	75
Tables:		
I. Special tools	--	33
II. Time standards	--	53
III. Specially designed tools	--	56
Tabulated data (field and depot maintenance):		
General	79*a*	53
Time standards	79*b*	53
Tabulated data (operator and organizational):		
Dimensions and weights	4*b*(1)	3
General	4*b*(2)	8
Telescope:		
Axis and 90° prism assemblies	134	90
Crosslines will not focus	52	42
Eyepiece	58, 131	44, 86
Eyepiece and reticle assemblies	131	86
Focus and objective assemblies	132	87
Level assembly	64, 65, 133	47, 90
Turns too hard or too easily	51, 100	42, 59
Will not stay on line	89	58

	Paragraph	Page
Theodolite operations	18	30
Theodolite will not seat properly on tripod head.	42, 88	41, 58
Time standards	79*b*	53
Tools:		
Basic issue	26	33
Special	24, 80	33, 56
Specially designed	82	56
Training, demolition	71	50
Tribrach:		
Assembly	60, 61, 102, 103	45, 60, 61
Circular level adjustment	17*b*	27
Clamp lever inoperative	101	59
Tripod:		
Assembly	66	47
Extension leg play excessive	41	41
Legs will not lock in position	40	41
Wrench	68	49
Troubleshooting (field and depot maintenance):		
Circular level bubble does not stay in center.	90	58
Collimation level bubble does not stay in center.	91	58
Compass assembly will not seat properly on compass bridge.	87	58
Compass circle will not balance or rotate freely.	84	58
Compass housing will not rotate on compass base.	85	58
Compass refernece mark not clearly visible or out of focus.	86	58
Field of vision not clear	93	59
General	83	58
Horizontal circle graduations not at right angles to line dividing the two images.	96	59
Horizontal circle hard to move	98	59
Illumination system faulty	97	59
Leveling screws hard to turn or have excessive play.	99	59
Light on horizontal circle unequal or absent.	95	59
Light on vertical circle unequal or absent.	94	59
Plate level bubble does not stay in center.	92	59
Telescope turns too hard or too easily.	100	59
Telescope will not stay on line	89	58
Theodolite will not seat properly on tripod head.	88	58
Tribrach clamp lever inoperative	101	59

	Paragraph	Page
Troubleshooting (operator and organizational maintenance):		
Circle and micrometer images will not focus.	53	42
Circular level bubble does not stay in center.	44	41
Collimation level bubble does not stay in center.	45	41
Compass assembly will not seat properly on theodolite mounting.	39	40
Compass circle will not rotate freely.	36	40
Compass housing will not rotate on compass base.	37	40
Compass reference mark not clearly visible.	38	40
General	35	40
Horizontal circle hard to move	49	41
Illumination system faulty or fails to function.	48	41
Instrument will not stay in line	43	41
Leveling screws hard to move or have excessive play.	50	41
Light on vertical and horizontal circles unequal or absent.	47	41
Plate level bubble does not stay in center.	46	41
Telescope crosslines will not focus	52	42
Telescope turns too hard or too easily.	51	42
Theodolite will not seat properly on tripod head.	42	41
Tripod extension leg play excessive.	41	41
Tripod legs will not lock in position.	40	41
Vertical:		
Axes:		
Inner	116	71
Outer	113	67
Circle assembly	125	80
Clamp	125	80
Collimation housing assembly	124	78
Collimation level assembly	122	77
Collimation lever assembly	124	78
Slow-motion screw	121	77
Adjustment	17*f*	28
U-standard assembly	135	90
Unloading equipment	6	9
Unpacking equipment	7	9
Weights and dimensions	4*b*(2)	8
Wrench, tripod	68	49

By Order of the Secretary of the Army:

EARLE G. WHEELER,
General, United States Army,
Chief of Staff.

Official:
J. C. LAMBERT,
Major General, United States Army,
The Adjutant General.

Distribution:

Active Army:

- USASA (2)
- DCSLOG (1)
- CNGB (1)
- TSG (1)
- CofEngrs (3)
- CSigO (1)
- CofT (1)
- USA Maint Bd (1)
- USAARTYBD (2)
- USAARMBD (2)
- USAIB (2)
- USAARADBD (2)
- USAAESWBD (2)
- USAAVNBD (2)
- USCONARC (3)
- USAMC (5)
- OS Maj Comd (5) except
  - USARJ (10)
- MDW (1)
- Armies (2)
- Corps (2)
- USA Corps (2)
- Div (2)
- Engr Bde (1)
- USMA (2)
- Svc College (2)
- Br Svc Sch (2) except
  - USAES (100)
- GENDEP (OS) (10)
- Engr Dep (OS) (10)
- Army Dep (2)
- USA Trans Tml Comd (2)
- Army Tml (1)
- USAMOCOM (2)
- USAOSA (2)
- Div Engr (2)
- Engr Dist (2)
- Engr Fld Maint Shops (2)
- USAERDL (3)
- Engr Cen (5)
- AMS (3)
- Chicago Engr Proc Ofc (10)
- USA Mob Spt Cen (36)
- ESCO (10)
- Fld Comd, DASA (8)
- USACOMZEUR (2)
- USAREUR Engr Sup Con Agcy (10)
- USAREUR Engr Proce Cen (2)
- MAAG (1)
- JBUSMC (1)
- Units org under fol TOE:
  - Two copies each unit UNOINDC:
    - 5-5
    - 5-6
    - 5-15
    - 5-16
    - 5-25
    - 5-26
    - 5-35
    - 5-36
    - 5-45
    - 5-46
    - 5-48
    - 5-52
    - 5-112
    - 5-115
    - 5-116
    - 5-117
    - 5-129
    - 5-145
    - 5-146
    - 5-155
    - 5-156
    - 5-225
    - 5-226
    - 5-237 (5)
    - 5-262 (5)
    - 5-267 (1)
    - 5-278 (5)
    - 5-279
    - 5-301
    - 5-352
    - 5-376
    - 5-420
    - 5-425
    - 5-426
    - 5-500 (HD, HF, HG, IA)
    - 5-600
    - 5-625
    - 5-626
    - 8-117
    - 8-204
    - 8-500, LA
    - 10-297
    - 10-445
    - 10-448
    - 10-500, (JF, JG)
    - 11-25
    - 11-26
    - 11-27
    - 29-52
    - 29-56
    - 29-57
    - 32-56
    - 32-78
    - 32-500, HV
    - 39-51
    - 39-61
    - 55-225
    - 55-227

NG: State AG (3).

USAR: Units—same as active Army except allowance is one copy to each unit.

For explanation of abbreviations used, see AR 320-50.

☆U.S. GOVERNMENT PRINTING OFFICE: 1989 - 242-451/06346